Electrical World

The consolidation of Electrical World and Engineer and American Electrician.

Vol. 57. NEW YORK, THURSDAY, JANUARY 26, 1911. No. 4.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

239 West Thirty-ninth Street, New York.

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TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico, $3.00 per year; Canada, $4.50 per year. All Other Countries, $6.00 per year. Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. Date on wrapper indicates the month at the end of which subscription expires.

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday of the week of issue.

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Entered as second-class matter at the post office at New York, N. Y.

The circulation of Electrical World for 1910 *was* 974,750. *Of this issue* 17,250 *copies are printed.*

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THE ELECTRONIC THEORY AND CORONA LOSS FROM TRANSMISSION LINES.

In the discussion before the American Institute of Electrical Engineers of the recent important paper by Prof. Harris J. Ryan on high-tension corona, much was talked about electrons and the electronic theory. In fact, so much was said about electrons that the subjects of corona and corona loss from high-tension conductors became somewhat overshadowed thereby. In the passage of electric discharges through gases the phenomena are so complex and hard to account for that the physicist has been glad to entertain any theories that offered promises of simplification. The electronic theory is the most promising one and has done more to explain the subject than any other yet proposed, but the matter is so complex that, even with the aid of a promising theory, very little progress has been made arithmetically in solving actual problems of spark discharge. The conflicting views of the theory set forth in the A. I. E. E. discussion indicate its present nebulous character.

According to the electronic theory there are two kinds of electricity, positive and negative. Each is composed of definite and seemingly indivisible charges—the electron charges. It is supposed that electricity is made up of similar parts, each part —the electron—being indivisible, or an electric atom. Not only are all electric charges composed of aggregations of electrons, but the atoms of matter are imagined to consist of organized groups of electrons, each chemical elementary substance having its atoms all composed of like electronic groups. The positive electron is hard to identify and is supposed to be a relatively large and slowly moving entity, but negative electrons are identifiable, isolatable, extremely minute and very mobile. It is supposed that the internal forces that bind together the numerous electrons in a chemical atom are electromagnetic forces, and likewise the chemical forces that bind atoms into molecules. According to this view, all matter is but organized associations of minute electric charges, and all chemistry is but the classification of the results of the electric forces connecting these charges. It is assumed, on the same theory, that if we understood the electronic organization of hydrogen and oxygen atoms we should be able to predicate the mutual chemical affinity of these atoms, and to predict the amount of heat liberated by their union into molecules of water. Up to the present time, however, it does not appear that any single chemical formula has been explained, much less predicted, by the electronic theory.

Nevertheless, there are seeming corroborations and confirmations of the electronic theory in view. If, for instance, we accept the electronic theory of the structure of matter, then the property of inertia in matter is accounted for. It is merely a particular case of electromagnetic inertia, as witnessed in electric circuits. In the electronic theory of discharge through gases gaseous molecules at ordinary temperature are to be regarded like solar systems perhaps, each with a positive elec-

tron nucleus, like the sun, and an attendant swarm of negative electron satellites. The electric force which connects the negative electrons elastically with the central positive sun is relatively so strong that no satellite electron can escape. Such solar systems are neither positive nor negative, as a whole, but neutral and electrically balanced. In free air, at ordinary temperatures, there are, however, a few casual negative electrons or disengaged satellites flying about loose. These may have been separated from their proper solar systems by the operation of specially powerful forces or ionizing forces, such as ultra-violet light, radio-activity, etc. These negative electrons are virtually minute unattached negatively electrified pith-balls. In any electrostatic field they are urged with great speed along the lines of the electric force, and may acquire thereby great velocities. Granted a sufficiently powerful electric field and a sufficiently great distance for the same to act in, the electron velocities attained will be sufficient to smash any regular solar-system atom with which the electron may subsequently collide. The disrupted satellites then form new free electrons, which in their turn may be urged to disrupt yet more atoms, until the region will be filled with free negative electrons, which is the same as saying that the region becomes conducting and that a discharge will occur through it.

The picture thus suggested to the mind may be a substantially correct presentation of the facts, and yet the complexity of the action may be so great that no quantitative help is derivable from it. The theory is not sufficiently far developed to enable us to solve problems arithmetically. The only help that the engineer can yet obtain from the electronic theory, in relation to high-tension corona loss, is qualitative help in grasping the origin and nature of the phenomena. In order to arrive at numerical relations he has to depend on the results of observations and on empirical formulas deduced therefrom. From a numerical point of view he would be as well off without any electronic theory. Nevertheless, it seems very likely that further quantitative advance from empirical to rational formulas will have to be made along the electronic theory, which is, therefore, to be developed and fostered, not discarded and ignored.

THE DETROIT TUNNEL SUBSTATION.

Elsewhere in our columns will be found a somewhat extended account of the very ingenious substation equipment used in the Detroit River Tunnel railway installation. The conditions in this plant are very peculiar, owing to the fact that it is operated by electrical energy purchased from the system of the Detroit Edison Company. On general principles a first-class central station should be able, and is able, to deliver power at a figure economically comparable with anything that is likely to be done by a local power plant save of the largest size. With powerful locomotives to deal with, however, on the somewhat severe service of the tunnel, it becomes necessary in thus purchasing power to take measures to equalize the load as far as possible, so as to avoid, in the first place, sudden peaks which might interfere with the general service of the supply company and also to avoid the high maximum demand which large peaks entail. To meet these requirements an extremely well-planned combination of motor-generators, storage battery and regulating devices was installed, so that the first 800 amp comes from the motor-generators and then the battery comes into play to take the peaks up to a little more than 8000 amp, after which a reserve of about 800 amp more may be drawn from the motor-generators as a last resort.

The motor-generator sets themselves are worth a little comment. The chief machines are a pair of 1000-kw synchronous motor-generator sets. Each set is a two-bearing unit on a common base, and is provided with a direct-connected exciter. The extraordinary feature of these machines is the very high efficiency, reaching a little over 95 per cent at full load and 92 per cent at half load. This efficiency is so high as to leave little margin for improvement, even if it were feasible to use synchronous converters for the peculiar requirements of the situation. In addition, a 50-kw reversely operated motor-generator set is provided, allowing high-voltage three-phase currents for lighting and incidental purposes to be generated from the main storage battery if necessary. Reference should be had to the article itself for the very interesting regulating devices, too intricate to summarize here. Their actual effect is to keep the load on the batteries as a regulator at all times when severe demands for current appear, save when by chance the capacity of the battery might be somewhat exceeded. In normal operation the regulating apparatus and battery preserve practically constant load on the supply lines. Only by the use of such devices can a central-supply station safely take on a relatively large railway load, but with them it becomes both feasible and economical so to do; and the chances are that as time goes on there will be more and more of this unification of current supply in a given territory, now that the engineering difficulties of the problem have been so successfully met.

UNUSUAL CURRENT RELATIONS IN CONDENSIVE AND INDUCTIVE CIRCUITS.

In dealing with simple direct-current circuits the action of Ohm's law in regard to the effect of resistances in series or in parallel is usually so clear that the behavior of the indications of the voltmeters and ammeters in the circuit is easily understood. When, however, we deal with alternating-current circuits, where Ohm's law applies in a two-dimensional sense instead of in a purely numerical sense, the actions in the circuit may be very puzzling at first sight. For instance, we may take a single-phase generator supplying current to a single condenser. The two terminals of the generator armature are to be connected through an ammeter with the two terminals of the condenser. A certain current strength will, of course, be indicated on the ammeter dial as flowing through the generator and condenser. If, now, a choking coil be connected in shunt to the condenser, the generator will be able to send a current through the choking coil as well as the current through the condenser, so that, at first thought, the current through the ammeter should be increased. Actually, however, the current may be diminished and, if the choking coil be carefully adjusted to the condenser, the current supplied by the generator to the two devices together may be very small.

The case described in the article on page 232, by Mr. Alfred Still, may be explained on somewhat similar lines. As shown in the article, a certain variable-ratio transformer takes a somewhat large lagging current for excitation. When condensers are connected to the secondary terminals a leading charging current is superposed upon the lagging current of excitation. The vector sum of a leading and a lagging current

may be smaller than either of the two components. Up to a certain point, therefore, the addition of leading current diminishes instead of increases the resultant primary current. The explanation given by Mr. Still seems to be entirely adequate, but the phenomenon is probably no more wonderful than occurs in every-day practice with a rotary condenser or synchronous machine operated on an alternating-current system partly as a synchronous motor and partly as a power-factor improver. Thus, such a machine may be receiving, say, 100 kva from the line. It may be delivering nearly 70 kw as a motor and at the same time nearly 70 kw of reactive power to the system, or apparently nearly 140 kw. in all.

Both the test results and the analysis thereof by Mr. Still have been kept in their simplest form by maintaining the voltage impressed on the condensive circuit at a constant value. If the voltage impressed on the primary circuit of the transformer of high magnetic leakage had been kept constant, then the secondary e.m.f. would have increased steadily with each addition to the condensive secondary load, the effect upon the primary current being cumulative to a certain extent. Thus each cable coil condenser connected to the secondary circuit would not only receive more current than the value taken by each coil already in circuit, but the latter coils would receive an increased current. This effect is attributable to the fact that the leading current drawn through the highly inductive reactance of the transformer coils raises the terminal e.m.f. of the circuits considered as a transmission system. The phenomena here considered are closely related to the so-called resonance phenomena when the leading component of the primary current equals the lagging component, but the resonance effect is rendered inconspicuous by reason of the presence of the power component to overcome the losses in the transformer core and coils.

PERFORMANCE TESTS OF SERIES TRANSFORMERS.

As is true of the so-called constant-potential or shunt transformer, the secondary current of a series transformer differs from the product of the primary current and the transformation ratio by an amount equivalent to the requirements for magnetizing the core. In a shunt transformer the exact ratio of the primary to the secondary current is of relatively small importance compared with the exactness of the voltage ratio, while in a series transformer the current ratio is of considerably more importance than is the voltage ratio. For this reason the series transformer is frequently referred to as a current transformer, but the phenomena in this transformer differ only in magnitude from those in a so-called voltage transformer. Elsewhere in this issue appears an article by Mr. H. S. Baker in which is described a method for determining the current ratio of a series transformer by opposing the m.m.f. of the primary current against that of the secondary current when the two currents are passed around a special test core. The relative values of the opposing m.m.fs. are varied by changing the ratio of turns on the test core. The adjustment cannot be so made that the resultant m.m.f. reduces to zero, because there is a certain time-phase displacement between the primary and secondary currents; but the ratio of turns on the test core when the resultant m.m.f. has its minimum value can well be taken as the current ratio of the series transformer under the conditions existing during the test. The chief feature of the method described resides in the scheme employed for determining when the adjustments made give the minimum resultant m.m.f. on the test core. The e.m.f. produced by the flux due to this m.m.f. is indirectly observed both in value and in relative time-phase position by impressing it upon the voltage coil of a wattmeter the current coil of which is subjected to currents of definite values displaced relatively by known time-phase angles. For this purpose use is made of a source of three-phase e.m.f. for the current coil of the wattmeter. In order for the wattmeter to record a deflection it is essential for the currents in its two coils to be of absolutely the same frequency, which fact points to the necessity for supplying the current to the series transformer from the three-phase source and for maintaining the three-phase e.m.f. constant throughout the tests. When proper precautions are taken the method should give good results. Being of the opposition variety, it should possess a considerable degree of accuracy when skilfully applied.

AUTOMATIC CONTROL OF TEMPERATURE.

The machinery of the solar system for heating the surface of the earth by the radiation of the sun is about the worst conceivable by the mind of thinking man, either from the standpoint of efficiency or from that of uniformity. It is saliently evident that the concept of warming animals, or of keeping their temperatures uniform, at the surface of the earth was not prominent in creative thought when the conditions of our partcular and insignificant little solar system were being forged in the giant smithy of Nature. Our own little heating machines for artificially warming inhabitable interiors are wasteful enough, and variable enough, to satisfy a profound pessimist; but they are models of efficiency and of regularity by comparison with solar radiation, from the standpoint of those who profess to believe that the sun was created for the purpose of giving life and warmth to man. We are only beginning to reconcile the exigencies of ventilation and of heating in our dwellings so as to combine warmth efficiency with hygiene. But for keeping the temperatures of our laboratories constant we already possess some fairly satisfactory devices.

A particular form of electric thermostat was described on page 112 of the *Electrical World* for Jan. 12, 1911, by Prof. A. A. Somerville. There are certain difficulties met with in all electrically controlled thermostats, and principal among these is the burning of the contacts at the automatic controlling switch Once these contacts get out of order the apparatus becomes unreliable and is apt to behave as though under the control of an intoxicated individual. Great care is, therefore, needed for insuring the maintenance of the contacting surfaces in effective condition. In the apparatus described in the article the contacting surfaces are both of liquid mercury. In the presence of air and under unfavorable conditions such mercury contacting surfaces might soon become dirty and unreliable, but under the conditions described in the article the contacts may evidently be kept in proper operative condition for an indefinite period. As mentioned in the article, the sensitiveness of this thermostat to casual changes of air-temperature depends in large measure upon the dimensions of the air-bulb. Large, thin-walled bulbs promptly bring their contained air close to the temperature of the external air, with corresponding change in the pressure or volume of the contents, whereas small, stout-walled bulbs are more sluggish in their action.

N. E. L. A. Growth.

With the new year the National Electric Light Association has taken another leap forward in membership and on Jan. 21 it crossed the 6500 line. This is a gross gain of over 1500 since the St. Louis convention and a net gain of about 1250. The Canadian Electrical Association voted last week to affiliate with the N. E. L. A. body and this will also bring a large accession; while new company sections are being formed in Pittsburgh, Allegheny City, Scranton, Connellsville, Pa., and other cities. Mr. H. H. Scott, the chairman of the membership committee, estimates that 7000 members will be enrolled by the end of the month and that the number may easily be 8000 by the next annual convention in June. The membership fifteen months ago was slightly over 3000. A number of smaller central-station companies are included in the new membership.

Oklahoma Decision on Regulation of Rates.

The Supreme Court of the State of Oklahoma has handed down a decision in a case involving the regulation of the rates of a telephone company which includes an interesting discussion of all the elements that enter into a proper determination of rates for telephonic service and incidentally of service supplied by any public utility company. The opinion, which is of such length that it cannot be here printed in full, is one of much interest, in this respect resembling the opinion of the Supreme Court in the case of the Knoxville Water Works Company, which is frequently quoted, and the several precedent-making opinions of the Wisconsin Railway Commission relating to the valuation of public service properties, etc., which are also quoted.

The case was an appeal from the Corporation Commission of Oklahoma, which had issued an order against an increase made by the Pioneer Telephone & Telegraph Company in the schedule of rates for Enid, Okla. The opinion states that the basis of calculations as to reasonableness of the rates to be charged by public service corporations is a fair valuation of the property used by the corporation in rendering service to the public, and the opinion then proceeds to establish in detail what constitutes fair valuation. It was held that when the present value of a telephone exchange plant is being ascertained for the purpose of determining what amount the company is entitled to earn as a fair return upon its investment, and such value is ascertained by determining what amount it would cost to reproduce the plant, a reasonable amount for interest on the capital invested in the equipment of the plant during the period of construction should be allowed. In estimating the cost of reproducing the plant a deduction for depreciation of the physical properties from age and use should be made from the estimated cost of reproduction or replacement new. Consideration should not be confined to the valuation of the bare physical plant, but where the exchange has a large patronage sufficient to pay operating expenses, fixed charges and some profits, and when such patronage has been built up by an expenditure of labor and money for a period of time during which the plant was operated at a loss, these points should be considered and a reasonable amount allowed to make good the depreciation of the plant and replace the deteriorated portions when they become so impaired that they can no longer be made usable by repair. Rates are not excessive, oppressive or unreasonable to the public that yield only sufficient revenue to pay operating expenses and fixed charges, including a reasonable amount for depreciation and a return, as in the present case, of less than the legal rate of interest on the value of the properties used in rendering the service.

In the valuation of the property the court added a sum equal to 20 per cent of the value of the physical property of the company, this addition representing a "going concern" value. In discussing what rate a public service corporation may be permitted to earn without constituting an unreasonable charge for the service rendered, it was stated that this is in a great measure determined by the character and amount of the investment, the return that other investments of similar character and amount in the same community yield and the prevailing rate of interest. Investments in telephone properties in Oklahoma cannot be regarded as investments of such high grade as state or federal bonds or as in communities where the demand for telephone service is established or more definitely ascertainable than where it is subject to the varying changes of a rapidly developing country.

In conclusion the court ordered that the schedule rates established by the company and ruled against by the commission shall be the rates hereafter charged; if, however, subsequent experience in the operation of the exchange at Enid develops that these rates operate oppressively upon the public, or fail to render a reasonable return upon the property, either party has a remedy for relief by application to the commission.

Wisconsin Electrical Contractors' Association.

The two half-day sessions of the Wisconsin Electrical Contractors' Association held at the Republican Hotel, Milwaukee, Jan. 17 and 18, were devoted to the discussion of business topics of particular interest to electrical contractors. The Wisconsin association comprises 20 members, all of whom, with one exception, were present at Milwaukee. For the next year officers were elected as follows: President, R. J. Nickles, Madison; vice-president, George Pohlman, Milwaukee; treasurer, George Knoerr, Milwaukee; secretary, Albert Petermann, Milwaukee (re-elected). Mr. F. W. Pittman, of Lacrosse, was elected to the board of directors, the other members of which are Messrs. G. E. Rohn, of Milwaukee, and A. C. Langstadt, of Appleton. The association holds two meetings each year. The summer meeting of 1911 will commence at Oshkosh some time in August, from which point the contractors will charter a vessel for four days, following the plan of preceding years, for a cruise up the Wolf River, stopping at night to disembark for sleeping. All the meetings and meals will be held on board the boat during the trip.

Wood Preservers' Association.

The seventh annual meeting of the Wood Preservers' Association was held in the Auditorium Hotel, Chicago, on Jan. 17, 18 and 19. President Walter Buehler, of St. Louis, was in the chair, and Mr. F. J. Angier, of Chicago, the secretary, performed the duties of his office. The attendance was about 100, composed principally of railroad men or commercial men interested in methods of wood preservation.

The discussions were technical to the art of wood preservation and were brought out by the following papers: *What Railroads Have Done for Forestry,* by Mr. E. A. Sterling, of Philadelphia; *Impurities in Zinc Chloride,* by Mr. C. M. Taylor, of Port Reading, N. J.; *Piling of Timber,* by Mr. J. H. Waterman, of Galesburg, Ill.; *General Review of Timber Treating in This Country,* by Mr. Walter Buehler, of St. Louis; *Results with Treated Ties Along the South Atlantic Coast,* by Mr. William A. Fisher, of Wilmington, N. C.; *The Covering of Retorts,* by Mr. R. W. Yarbrough, of Texarkana, Tex.; *Plants in the North and in the South,* by Mr. Andrew Gibson, of Brainerd, Minn.; *Grouping Timbers for Treatment,* by Mr. W. F. Goltra, of Cleveland, Ohio; *Penetrations from Different Amounts of Preservatives,* by Mr. R. L. Allardyce, of Texarkana, Tex.; *Prolonging the Life of Railway Cross Ties,* by Mr. F. J. Angier, of Chicago; *Treatment of Sawed and Hewn Ties,* by Mr. H. J. Whitmore, of Denison, Tex.; *Depths of Penetration with Different Amounts of Preservatives,* by Mr. David Allerton, of Madison, Ill.; *Benefits of the Annual Meetings,* by Mr. William Townsley, Jr., of Cleveland; *Withdrawal of Creosote from Wood by Subsequent Vacuum,* by Mr. C. E. Chanute, of Chicago, and *General Review of Timber Treating in this Country,* by Mr. John T. Logan, of Texarkana, Tex.

This list of papers indicates the varied aspects of the art of wood preservation. It is the province of the Wood Preservers' Association to maintain a high standard of professional procedure in the work. One point brought out which may be of some importance to electrical men interested in the preservation of poles is that creosote penetrates farther into wood than the discoloration of the wood would indicate.

Officers were elected as follows: President, Mr. John T. Logan, Texarkana, Tex.; vice-presidents, Andrew Gibson, of Brainerd, Minn.; Mr. R. J. Calder, of Galveston, Tex., and D. Burkhalter, of Bradford, Pa.; secretary-treasurer, Mr. F. J. Angier, 1033 First National Bank Building, Chicago. The next annual meeting will be held in Chicago on Jan. 16 to 18, 1912.

Electric Power Club.

The midwinter meeting of the recently organized Electric Power Club was held at the University Club in Chicago on the evening of Jan. 17. The gentlement present, to the number of about thirty-five, sat down to a dinner and afterward there were several speeches. President Hobart delivered an address of welcome and Mr. James Burke, of Erie, Pa., performed the duties of toastmaster. Dr. R. A. Millikan, professor of physics in the University of Chicago, spoke on the "Atomic Theory of Electricity"; Mr. Charles A. Brown, of Brown & Williams, patent lawyers, Chicago, on "The Relation of Patents to Pooling Agreements," and Mr. Frederic P. Vose, of Vose & Page, lawyers, Chicago, on "The American Attitude Toward Law."

The Electric Power Club is an organization of national scope, having for its object not only the social commingling of its members, but also, in a general way, the standardizing of electrical apparatus from an engineering point of view. At its meetings papers are presented on technical subjects and also on the technical problems of electrical manufacturing. Mr. C. A. Hobart, of Cincinnati, is president of the club; Mr. E. R. Harding, of Chicago, is treasurer, and Mr. Charles A. Roth, of Chicago, is secretary.

Meeting of the Indiana Engineering Society.

The fourteenth annual meeting of the Indiana Engineering Society was held in the Denison Hotel, Indianapolis, Jan. 12 to 14, the registration reaching eighty-five. Ten new members were admitted to membership. The meeting was called to order by E. E. Watts, of Princeton, who deplored the fact that public money is being wasted by incompetent engineers and recommended an amendment to the present law fixing adequate compensation for engineers on public work. He thought engineers should pass an examination for registration by a State board and only men thus qualified should be permitted to take employment on public works.

In his report as chairman of the committee on mechanical engineering Mr. O. B. Zimmerman said there is a lack of technical instruction in secondary schools which accounts for the primary studies in the curricula of technical schools. An interesting talk was given at the morning session of the concluding day by Mr. Frank R. Daniels, of Indianapolis, on "The Prevention of Electrolysis." He said corrosive action of the kind which has done much damage to underground pipes can be checked and practically eliminated by careful study of conditions and the application of modern principles of insulation and conduction. Because of the large losses suffered by electric lines from theft, the roads are adopting the welded rail bond, as more satisfactory than the type that can be removed and sold for the copper of which it is made. Mr. Charles A. Tripp, of Indianapolis, made a brief report of the year's advances in electric construction, saying that while no new inventions had been brought out the advance in electrical equipment had been in some respects remarkable. Mr. Tripp followed his report by reading a paper on the application of "Individual Electric Drives to Textile Machinery." He said there was a growing tendency of engineers to abandon the shaft and pulley for separate motors regardless of the difference in the cost of placing and operation.

The following officers were elected for the ensuing year: President, Mr. Daniel T. Luten, Indianapolis; vice-president, Mr. Malvard A. Howe, Terre Haute; secretary, Mr. Charles Brossmann.

Byllesby Convention in Chicago.

The second annual convention of the employees of H. M. Byllesby & Company and affiliated public service companies was held in the Congress Hotel, Chicago, Jan. 12-20. The registered attendance was 286, 128 of this number being from the home office in Chicago and 158 from the various affiliated companies scattered throughout the country, these latter operating electric service, street railway, gas, power-transmission and telephone utilities in eighty-two municipalities throughout the West and South.

The meeting was opened by an address by Mr. H. M. Byllesby, president of the parent company, who in the course of his speech gave some interesting statistics showing the magnitude and extent of the work carried on under the direction of the company of which he is the head. A year ago the company was operating in forty different municipalities, while at present its activities embrace eighty-two different municipalities in this country, which are spread broadly from the Canadian border on the north to the Gulf of Mexico on the south and from Illinois to the Pacific Ocean on the west. The employees directly on the pay rolls of H. M. Byllesby & Company are 138 and those permanently and directly in the field in the various local companies aggregate 2400, making a total of 2538 regular employees. In addition, during the last twelve months an average of 2000 men have been at work in the field on construction, making a grand total of 4538 individuals employed and corresponding to about 23,000 individuals whose livelihood depended upon the interests represented at the meeting.

As compared with the Commonwealth Edison Company, which has 125,000 consumers, the interests represented have 129,146 consumers. The Byllesby company on Dec. 31, 1910, had $157,000 more cash in hand and $700,000 less liabilities. According to the report of the firm which audited the accounts of the company, during the past year its worldly wealth was increased by the sum of $758,356.53, and it was certified that the company on Dec. 31, 1910, had a capital and assets beyond all liabilities of $4,230,000. During the year 1909 the sale of securities was between $12,000,000 and $13,000,000, while in the past year it was between $22,500,000 and $23,000,000.

Mr. Byllesby called attention to the action of a prominent public service commission in one of the States in which the company operates largely, which has prepared a bill to submit to its State Legislature whereby public service corporations are authorized, after having capitalized at market value in stocks and bonds for the actual cash cost of their properties, to add thereto 100 per cent of "profit-sharing stock," thus recognizing the value of encouraging industry and enterprise. Mr. Byllesby considers that this is one of the most remarkable steps in advance that have taken place in the public service business in the thirty years during which he has been connected with it. Mr. F. H. Tidnan, manager of the Oklahoma Gas & Electric Company and chairman of the convention, responded in appropriate terms to Mr. Byllesby's address.

During the four days' convention fifteen papers were presented, among which were the following having a direct electrical bearing: "Ornamental Curb Lighting," by Mr. B. W. Cowperthwait, of Faribault, Minn.; "Effective Illumination," by Mr. A. Larney, of Oklahoma City; "Central Station Economics," by Mr. Eugene Holcomb, of St. Paul, Minn.; "Unusual Engineering Design and Construction," by Mr. W. R. Thompson, of Chicago; "Construction of Hydroelectric Plants Relative to Economy in Operation," by Mr. J. M. Link, of Chi-

cago; "Electric Versus Horse-Drawn Wagons," by Mr. F. H. Tidnan, of Oklahoma City; "The Effect of High-Efficiency Lamps on the Central-Station Industry," by Mr. Alex F. Douglas; "District System of Meter Reading," by Mr. T. K. Jackson, of Mobile.

On Wednesday afternoon Mr. Samuel Insull, president of the Commonwealth Edison Company, gave an address on modern methods of conducting central-station business, and later in the same day Mr. Byllesby gave some interesting reminiscences of the days of electric lighting in the early eighties, when the speaker was a member of the staff of Mr. T. A. Edison.

On the recommendation of a committee of which Mr. Harold Almert, of Chicago, is chairman it was decided to start a monthly technical and commercial paper to serve as a medium of communication between the various companies and interests affiliated with H. M. Byllesby & Company. It was also decided to collect information on industrial power for a data book to be furnished to all representatives of the companies interested in the various States, which will show the characteristics of various industrial plants using electric drive supplied with electrial energy by the various affiliated companies. The book will contain information about load-factors, connected load, power required to drive various types of machinery, etc.

On Tuesday afternoon, Jan. 17, Mr. and Mrs. Byllesby gave a reception at the Drexel Boulevard home to the delegates of the convention. Opportunity was also offered to visit the Chicago Electrical Show. Thursday evening there was a theater party. There were also excursions to the Fisk Street power house and Division Street gas works. On Friday evening a banquet was given at the Congress Hotel, at which speeches were made by Mr. Samuel Insull; Mr. Frank H. Jones, vice-president of the Continental & Commercial Trust & Savings Bank, of Chicago; Rev. Dr. Herman Page, of the St. Paul Protestant Episcopal Church, Chicago; Mr. E. S. Kiser, of the Chicago *Record-Herald,* and Mr. J. R. McKee, of the General Electric Company.

Mr. T. J. Jackson, president and general manager of the Mobile Electric Company, was elected chairman to preside at the opening of the next convention, which will be held in Chicago next January; Mr. E. M. Emery, of Mobile, was appointed secretary of the convention, and Mr. R. J. Graf, of Chicago, treasurer.

The officers of H. M. Byllesby & Company are as follows: President, Mr. H. M. Byllesby; vice-president, in charge of operation, Mr. A. S. Huey; vice-president and chief engineer, Mr. O. E. Osthoff; vice-presidents, Messrs. J. S. Cummins, of Chicago, and C. E. Groesbeck, of Portland, Ore., in charge of Pacific Coast interests; treasurer, in charge of auditing, Mr. J. J. O'Brien; secretary, Mr. R. J. Graf; assistant treasurer, Mr. R. E. Wilsey.

Electricity in Iron and Steel Making.

A symposium on the subject of the manufacture of iron and steel by electric furnace methods held under the auspices of the Chicago Section of the American Electrochemical Society, Jan. 20, brought out a record attendance of interested chemists and engineers which taxed the assembly hall of the Western Society of Engineers in the Monadnock Block, Chicago, where the meeting was held.

Mr. James Lyman, district engineer for the General Electric Company, opened the subject by describing the construction, use and advantages of various types of electric furnaces. Present steel-making methods have been refined almost to their ultimate limit, said Mr. Lyman, and, although the quality and output have been increased all along the processes, such reduction methods requiring fuel combustion have the disadvantages of being difficult to handle and may produce non-homogeneous material and introduce impurities into the product unless great care is taken. The electric furnace, however, working without fuel, permits reactions to be carried on in a neutral atmosphere without the addition of impurities, and allows higher temperatures, greater fluidity of flux and metal, and closer control of furnace processes, making possible the production of hitherto unknown steels and alloys. The cost of electricity for steel-making processes, when obtained from water-power or blast-furnace gas sources, is quite comparable to the cost of high-grade fuel in the older processes. A large proportion of fuel in the ordinary furnace is used to produce and maintain smelting temperature, only a small fraction of this quantity being actually needed for the reducing reactions. In 1904 only four electric furnaces were in use in Europe, while to-day more than 100, ranging in capacity from 100 lb. to 15 tons, are in service here and abroad.

Electric furnaces are of two kinds, the arc furnace, in which the heating current is led into the furnace by electrodes, and the induction furnace, in which the metal to be heated forms the single-turn secondary of a transformer. Induction furnaces are limited to refining operations, and at commercial frequencies may have very low power-factors. In a Frick induction furnace, described by Mr. Lyman, energy is obtained from a frequency changer delivering 5 cycles to 15 cycles per second, single-phase, for securing a higher power-factor. This furnace consumes 660 kw-hours per ton per melt and has a heat efficiency of 65 per cent. A three-phase Rodenhauser furnace was also described, in which the metal pool included three annular troughs about the three legs of the furnace magnetic core. In these induction furnaces forced draft is applied between the metal walls and the core and primary windings, keeping the latter at normal machinery temperatures, not exceeding 70 deg. Stray fields in these induction furnaces produce a stirring action in the molten metal which improves the quality of the steel produced.

Arc furnaces possess the advantage of higher power-factors at commercial frequencies and are available for smelting processes. A 25-ton Frick arc furnace, taking 2000 kw, shows an efficiency of 80 per cent. Like a Swedish furnace also mentioned by Mr. Lyman, the gases from the furnace top are returned by a blower to tuyeres at the combustion zone. The electrodes are mounted at the sides of the combustion chamber, as in the Héroult furnace. In the Girod arc furnace a large upper electrode forms one terminal, the other being made up of numerous small conductor rods embedded in the furnace floor. In the Keller arc furnace the electrodes are dropped through hatches into the molten mass, being arranged with boom gear for renewing the terminals as they become destroyed. The Stassano furnace employs an arc between electrodes in the wall directly over the metal bath. Ordinary open-hearth efficiency is placed at about 25 per cent to 30 per cent, while the overall efficiency of gas-engine transformers and electric furnaces is 15 per cent (the engines having a thermal efficiency of only 20 per cent, which reduces the excellent efficiencies of the other apparatus). Electric furnaces, said Mr. Lyman, make possible superior castings since they permit more accurate alloy ratios and a greater fluidity before pouring.

Mr. F. T. Snyder, of the Metallurgic Engineering Company, discussed the reliability of electric furnaces for commercial work. The years of experience with the electric furnace in the aluminum, calcium-carbide, carborundum and other industries, he said, have demonstrated its reliability in commercial use, besides developing complete lines of supplies and parts which are now available on the market for the steel industry. To illustrate the practical simplicity of electric furnace working, Mr. Snyder told of a furnace in the West which has been operated for several years by Chinese labor supervised by a white superintendent. While coal and other fuels are rising in values, the cost of electricity is lowering, indicating that the electric furnace is the furnace of the future. It will also have an important use in enabling manufacturers to produce high-grade steel castings from scrap, taking the place of certain forgings.

Prof. C. F. Burgess, of the University of Wisconsin, spoke of the possibility of electrolytic refining as a step in the production of steel. Although the electrolytic refining of copper,

gold, silver and lead has played a most important part in the metallurgy of these metals, it has hitherto been impossible to deposit iron satisfactorily, due to the coating assuming a dark, rough, powdery quality before any useful thickness is deposited. Professor Burgess then exhibited an iron cathode which he had succeeded in depositing after several years' experimenting, during which time about 3 tons have been refined and 1000 alloys tested. The cathode shown, without doubt the largest piece of electrolytic iron in the world, was 2 in. thick and weighed 75 lb. This was deposited from a mixed solution of ferrous sulphate and ammonium chloride containing 40 gr of iron to the liter, and using a current density of from 6 amp to 10 amp per square foot at a potential difference of 1 volt. The current efficiency was nearly 100 per cent under these conditions, 1 kw-hour refining about 2 lb. of iron. The iron deposited from double refining, using a high-grade material as anode, can be produced of a purity of 99.7 per cent. This iron is quite brittle, due to occlusion of hydrogen, and can be easily shattered by a sledge-hammer for breaking up and charging into an electric furnace. Such electrolytic iron can be produced at $55 a ton commercially, said Professor Burgess, comparing well with high-grade Swedish iron.

Mr. Charles G. Osborne, superintendent of special steels for the Illinois Steel Company, told of the experiences with the 15-ton Héroult furnace at South Chicago. The current is led into three furnaces by three huge electrodes, 24 in. in diameter and 14 ft. long, placed at the apices of a triangle 5 ft. on a side. The adjustment of these electrodes is done both by hand regulation and automatically. In series with current transformers in each furnace lead are relay coils whose attraction is opposed by springs. If the electrode current varies, destroying this balance, one of two opposed dogs is clutched into an oscillating rack wheel, turning a switch arm to operate the electrode-hoist motor in one direction or the other, as required, and adjusting the electrode within ⅛ in. The furnace pressure varies between 80 volts and 110 volts. In some sample runs, of which records were shown, the current was on for forty-four minutes, then thirty-seven minutes later the furnace was tapped, the entire "heat" lasting eighty-one minutes. The heats were repeated at approximately 100-minute intervals. The South Chicago furnace has been worked on probably the greatest variety of products of any steel furnace in the world, and has been run at times on such unpromising material as cold stove plates and "wire-whiskers." The steel produced has shown a greater freedom from oxidization and higher ductility and tensile strength than has been the case with similar open-hearth steels.

Wisconsin Electrical Association at Milwaukee.

The Wisconsin Electrical Association, comprising representatives from the electric lighting and electric railway properties of the State, was called to order Wednesday morning, Jan. 18, at the Hotel Pfister, Milwaukee, by Vice-president George B. Wheeler, of Eau Claire, in the absence of President Clement C. Smith, who was detained from the sessions by illness. Nearly 100 members, including operating men and supply salesmen, were present. The secretary's report was presented by Secretary J. S. Allen, of Lake Geneva, and showed the association to be in a flourishing condition with more than $1,000 deposited to its credit in the bank and all bills paid.

Mr. Ernest Gonzenbach, of Sheboygan, read a paper on "Publicity Campaigns," in which he advocated carefully prepared advertising directed to the ultimate consumer of public-utility service. The good will of customers should be cultivated directly, he said, without resorting to political middlemen for favors. The speaker discussed newspapers, company publications, billboards and street-car cards for advertising purposes, and pointed out that in any case the material used must be exceedingly well-written and pungent to be attention-compelling and successful. He advocated the use of space in those newspapers of largest circulation regardless of editorial policy or journalistic class, observing that with their larger number the less well-to-do readers are quite as good public-service customers as the so-called better class of citizens. When the newspaper's editorial policy is appreciative of the company it is well enough to use advertising space, said Mr. Gonzenbach, but the reasons are far greater for doing so if the paper is antagonistic, as carefully prepared rebuttals should then be employed to counteract unfavorable statements in the reading columns. Street-car advertising should supplement the use of billboards, especially where the electric light company operates both utilities. The best advertising space in the cars should be retained for this purpose. Before closing Mr. Gonzenbach deplored those public-service managers who to secure peace at any cost submit to imposition from customers or interests. Such peace, without honor, and at the cost of self-respect, will never bring prosperity, said the speaker. The public admires a plucky fighter, and if it can be convinced that the corporation's position is sound and is undergoing attack from unworthy motives the offending elected representative will be thoroughly discredited and the contest result to the company's advantage.

Mr. W. H. Winslow, of Superior, spoke of the necessity for care in the preparation of advertising matter, and Mr. Glenn Marston, of Chicago, urged that newspaper advertising should be undertaken only with the view of securing direct results from readers, avoiding any purpose of tribute. He advocated the use of copy prepared by experts who understand public sentiment, tell their story directly and avoid technicalities. Mr. Marston recommended a policy of absolute frankness in public-service management.

At the opening of the afternoon session a brief address was made by Mr. T. F. Grover, former president of the association, now of Terre Haute, Ind., and telegrams of congratulation to the convention were read from Messrs. H. J. Gille, Minneapolis, Minn.; J. H. Harding, Los Angeles; D. C. Jackson, Boston, and Harold Almert, Chicago, all of whom were formerly identified with the association. Mr. A. W. Brady, president of the American Electric Railway Association, also telegraphed extending the national association's greetings and asking the co-operation of the Wisconsin men.

Mr. Edwin S. Mack, of the law firm of Miller, Mack & Fairchild, Milwaukee, then presented an instructive and carefully prepared discussion of the "Principles Established by the Decisions of the Wisconsin Railroad Commission." A full enumeration of these interesting points will be given later in these columns. Following Mr. Mack, State Senator G. B. Hudnall, of the Wisconsin Legislature, was introduced to the convention as "the father of the public-utility commission law of Wisconsin," and remarked that the success of the act had been due to the high personnel of the commission and to the co-operation of the companies themselves.

A new constitution for the Wisconsin association was presented by Mr. Irving P. Lord, of Waupaca, chairman of the constitution committee, and was ratified by the convention after brief discussion. The committee on affiliation with the National Electric Light Association, consisting of Messrs. P. H. Korst, of Janesville; L. L. Tessier, of De Pere, and W. R. Putnam, of Marinette, reported advising against such affiliation owing to the difference in eligibility rules and the resulting possible exclusion of valuable members from the local association. Co-operation in every way with the national association was recommended by the committee.

The association dinner was held on Wednesday evening in the Red Room of the Hotel Pfister. Acting-president G. B. Wheeler introduced as toastmaster Mr. C. N. Duffy, of Milwaukee. This well-equipped gentlemen, between appropriate introductory remarks of his own, called upon Messrs. F. G. Bolles, Milwaukee; C. M. Axford, Chicago; I. P. Lord, Waupaca; Professor Breckenridge, of Yale University; Oliver C. Fuller, banker, Milwaukee, and Prof. Shailer Matthews, of the University of Chicago, all of whom responded in humorous vein. The address of Professor Matthews, however, included

also a more serious and contemplative view of the changes that are going on in industrial conditions and their significance. The increasing personal consideration granted employees, the responsibilities of capital and wealth, and the hopeful signs for the future of business and industry directed by trained men were some of the subjects discussed in this talk by the head of the Chicago University divinity school and editor of *The World To-Day.*

Thursday morning's session was opened by Mr. A. J. Goedjen, superintendent of tests for the Milwaukee Electric Railway & Light Company, with a paper on "Meters and Meter Testing." Mr. Goedjen's paper was discussed by Messrs. J. M. Canby, meter expert of the Wisconsin commission; I. P. Lord, E. Gonzenbach, Prof. C. M. Jansky, of the University of Wisconsin; Mr. McNaughton and H. G. Nutting, of Fort Atkinson. A complete abstract of paper and discussion will be given in a later issue.

Mr. Frank A. Cannon, secretary of the Citizens' Association of Milwaukee, appeared before the association to enlist its sanction and co-operation for an electrical show to be held at the Auditorium in Milwaukee next January following the Chicago show.

Mr. C. M. Axford, of Chicago, read a paper on "Ornamental Street Lighting," discussing electricity as an advertising medium. Good street lighting, said the speaker, advertises the town and automatically increases the use of electricity. Mr. Axford urged that ornamental fixtures should be chosen of uniform design throughout a given city, and suggested improving the advertising value of sign displays by keeping all lighting units below a level of, say, 15 ft. above the street surface, while signs are erected at a height of from 20 ft. to 30 ft. He also pointed out the lower cost of installation and operation of high-efficiency arc-lamp illuminants to produce the same intensities and distribution given by tungsten-pillar installations. Mr. W. H. Winslow, of Superior, declared that the special street illumination in his city rather than discouraging merchants from window lighting has been the cause of intensive illuminations, since otherwise the windows appeared dark contrasted with the bright lighting outside. Good window lighting, he said, in turn reacts to produce high intensities in store interiors and in residences. Messrs. M. C. Ewing, of Wausau; R. M. Kimball, of Kenosha, and C. N. Duffy, of Milwaukee, also recounted their own companies' experiences with special lighting.

At the afternoon session Mr. W. J. Kelsh, master mechanic and chief engineer of the Eastern Wisconsin Railway & Light Company and the Wisconsin Electric Railway Company, Oshkosh, read a paper on "Electric Railway Repair Shop Practice," detailing some of the methods and economies employed by his companies. The subject of the paper was discussed by Messrs. J. P. Pulliam, of Oshkosh; W. H. Stevenson, of Chicago; J. C. Justensen, of Wausau, and Mr. Mullet, of Milwaukee.

Mr. C. N. Duffy, comptroller of the Milwaukee Electric Railway & Light Company, discussed the subject of "Insurance," recounting the experience and policy of the Milwaukee company. After referring to the excessive insurance rates generally charged on central-station and electric-railway properties in spite of modern construction methods, Mr. Duffy pointed out that the subject of insurance affects railway properties more than electric lighting companies on account of the former's large proportion of perishable properties in car stocks. In 1908 the Milwaukee company expended $15,000 in carrying out changes in its car barns recommended by the insurance inspectors, including the institution of fire drills, approved storage of oils and paints, cleaning of pits and concealed spaces, lowering of trolleys in car houses, provision of waste cans, extinguishers and sprinklers, etc. These changes, at a cost of $15,000, secured a reduction in rate from $1.40 to $1 per hundred, involving a yearly saving on $2,000,000 of the difference between $28,000 and $20,000 for the Milwaukee city lines car-barn property. The placing of this insurance is divided among all of the Milwaukee agencies, following a policy established by Mr. Beggs a number of years ago. No insurance is carried on the fireproof Public Service Building or the two power plants of the company. The Milwaukee company has instituted a fire-insurance reserve of $500,000, the 5 per cent annual interest on which, $25,000, goes back to the fund. Five-eighths of 1 per cent of the gross earnings of the company is also credited to the fund in monthly instalments, after paying the current insurance premiums. The ability of the company to carry its own insurance risk if necessary probably exerted a potent influence in obtaining the reduction which the insurance companies finally consented to give. Mr. Duffy advocated the display of consideration and reasonableness by both electric companies and insurance agents in securing the desired decrease in rates on electric properties.

Mr. A. K. Ellis, of Appleton, explained how, by the expenditure of several hundred dollars in carrying out recommendations, his company had secured a rate reduction from $1.84 to $1.50. Mr. R. N. Kimball, of Kenosha, said that in the case of the first fire his company sustained under classified insurance rates the company was forced to share the loss with the insurance people. Later he insisted on a blanket rate, without classifications, and when the second fire occurred the adjustment was a satisfactory and simple matter. Mr. F. A. Hecker, of Antigo, told of a reduction from $2.50 to 80 cents secured by rebuilding the plant. Mr. Douglass, commercial engineer of the Milwaukee company, deplored the often too literal interpretation of insurance rulings without individual judgment, citing a case where a 500-volt motor in the center of a foundry where molten metal was poured was required to be inclosed in a brick compartment for "fire-protection" reasons. Houses containing the most modern wiring construction obtain the same insurance rate as those equipped with gasoline-lighting systems, if the latter have been "approved."

President-Elect George B. Wheeler.

Mr. John I. Beggs, president and general manager of the Milwaukee Electric Railway & Light Company, was called upon for a brief address, and urged co-operation between public-utility corporations. Such mutual assistance, he said, is especially needed by the smaller companies which cannot afford to employ specialists in their technical, accounting and operating departments. Mr. Beggs spoke of the fair treatment received by the companies from the Wisconsin commission in spite of public clamor, and declared that proper principles resolutely adhered to would in the end win out. Mr. Beggs was warmly applauded.

A special committee on street lighting was appointed, consisting of Messrs. Winslow, Ewing and Axford. The selection of officers made by the nominating committee, Messrs. Gonzenbach, Vallier and B. G. Broad, was unanimously approved by the convention, and these officers were declared elected: President, Mr. George B. Wheeler, Eau Claire; first vice-president, Mr. Irving P. Lord, Waupaca; second vice-president, Mr. R. N. Kimball, Kenosha; secretary-treasurer, Mr. George Allison, Milwaukee.

Mr. George B. Wheeler, president-elect, is a graduate of Bowdoin College, Illinois. After engaging in journalism for a number of years he entered the electric railway field in 1891 as general manager of the Eau Claire (Wis.) Street Railway, Light & Power Company. Subsequently he was receiver of the property in the United States Court, and after the reorganization he was elected secretary and general manager of the property, which has since been succeeded by the Chippewa Valley Railway, Light & Power Company. This company now owns all the water-power on the Menomonie River and a valuable water-power on the Chippewa River, and supplies all the electricity used in Eau Claire, Chippewa Falls, Menomonie and Bloomer, Wis.; Red Wing, Minn., and numerous small towns.

Arc Lamp Practice.—Electric Meters.

The regular January meeting of the Boston Edison Section of the National Electric Light Association was held at the Edison Building, Boston, on the evening of Jan. 17, with Mr. R. E. Curtis in the chair. Papers were read by Mr. C. H. Ingalls, head of the meter division, on "Electric Meters," and by Mr. J. C. Norcross, assistant to the superintendent of installations, on "Arc Lamp Practice." Following the two papers of the evening the section adjourned to the Boston Edison Company's meter and lamp shops, where the various types of equipment mentioned in the papers were exhibited, with apparatus for testing and maintenance.

The paper by Mr. Norcross reviewed the evolution of the arc lamp in considerable detail, ranging from early types used by the Boston Edison Company to the present types of magnetite and flaming arcs used on the streets of Boston, with additional references to lamps adapted to indoor service.

Mr. Ingalls emphasized the importance of a high degree of accuracy in meters, pointing out that the desire of all companies of standing to deal fairly with every customer alone demands the use of an instrument of precision. He touched upon the importance of the meter in relation to central station income, showing that in round numbers every per cent loss due to meter inaccuracy is the equivalent of about 5 per cent of the total generating expense, or about 7 per cent of the total distributing expense. A gain in meter accuracy of only 1 per cent would pay for the expense of maintaining a first-class meter department. Bills of $1,000 a month are frequently recorded on a single meter. In selecting meters Mr. Ingalls said that the weight of the rotating element should be small and the torque relatively large. If a commutator is used, it should be of small diameter, to cause minimum friction. He described the principal types of meters now in general service and emphasized the importance of careful installation. Jewel wear and commutator troubles are the principal factors that affect the accuracy of meters. In some meters the weight on the jewel is several ounces, and on account of the small bearing surface the pressure actually exerted is in reality at the rate of some tons per square inch. The safe length of life of a sapphire jewel is within limits a function of the weight and number of revolutions of the rotating element of the meter, and as the friction of the commutator is similarly governed it is customary in some cases to base the period of time between tests on the time required for any meter to run from 800,000 to 1,000,000 revolutions for commutator meters and to about 2,000,000 for induction meters. Under this system the test times vary from two months to a maximum of twelve months for commutator meters, and from twelve to twenty-four months for induction meters.

Mr. Ingalls described the methods of testing employed in the Boston Edison Company's meter division, taking up gear ratio determinations, meter constants, disk rotations, comparisons with standards, stop-watch tests, single tests and multiple tests of meters in banks. The Boston Edison system of testing is based on a method of determining the rate of rotation of the disk and comparing that rate with the computed rate based on the actual energy in watts that is being measured by the meters. The laboratory is equipped for testing meters in series with a master meter, with a sounder connection which facilitates the adjustment of the disk speeds. For portable testing the company has developed a load box of one-fifth the weight of commercial devices. This box has been run as high as 80 amp at 220 volts, or about 18 kw, and weighs complete about 6¼ lb. By using a standardized resistance as a load box the company is enabled to omit the ammeter in testing a direct-current meter on the system. For testing the 600-amp to 2000-amp street railway meters now used by the company on the system of the Boston Suburban Electric Companies a special form of Wheatstone bridge has been designed. This obviates the need of carrying large and heavy batteries and permits the use of a direct-current rotating standard with satisfactory results. On an average the company's meters are found at the end of their assigned period less than 2 per cent slow on full load and less than 5 per cent slow on 10 per cent load. Tendencies are always toward the slowing of the meter on account of its ageing and friction increases. The tests of the Massachusetts Gas & Electric Light Commission on Boston Edison meters for the past eight years show an average accuracy of the meters to be 1.00078, or only eight-ten-thousandths of 1 per cent fast, the tests being the average of readings at one-fifth, one-half and full load. In only four cases the meter fell outside the State limit of 5 per cent, and in each case this was due to light load errors. In the past year the company tested 36,500 meters, and it now has installed on its system 42,300 meters. By the use of cupped diamond bearings a life has already been secured of over 50,000,000 revolutions, with the bearings still apparently as good as new.

Meeting of Electric Vehicle Association of America.

The regular monthly meeting of the Electric Vehicle Association of America held in the Engineering Societies Building, New York, Jan. 17, proved to be the best attended meeting thus far held by the infant organization, about 300 being present. The topic for the evening was an illustrated lecture on the "Ironclad Exide" battery, by Mr. Bruce Ford, of the Electric Storage Battery Company, of Philadelphia. The lecturer confined himself chiefly to a description of the battery rather than to data on its performance and added little to what has already been published. Briefly stated, the "Ironclad Exide" battery is of the lead-sulphuric-acid type and its principal feature of novelty resides in the construction of the positive plate, the negative being similar to the present Exide plate, only a trifle thicker. The grid of the positive plate is composed of a number of parallel vertical metal rods, united at their tops and bottoms integrally to top and bottom frames, the top being supplied with the usual conducting lug. Each vertical rod forms a core surrounded by a cylindrical pencil of peroxide of lead active material, which in turn is inclosed by a hard rubber tube supplied with a multiplicity of fine horizontal laminations to provide access for the electrolyte to the active material and passages for the flow of current during the charge and discharge of the plate. The tube fits snugly upon the active material and is furnished with two oppositely disposed vertical ribs which serve to stiffen and strengthen the laminated tube and act as separators. Improvements have also been made in the methods of mounting and connecting the plates.

The characteristics of the cell in discharge are similar to those of other types of lead batteries, the potential at a normal four-hour rate starting above 2 volts and maintaining a fairly uniform value throughout the discharge until toward the end, when it drops more rapidly. At 1.75 volts the cell is practically discharged. During charge its characteristics are similar to those of other lead batteries. While its capacity decreases at a less than constant rate of charge with increase of discharge rate, its capacity becomes greater at an increasing rate as the discharge rate becomes less. The battery is rated initially at four and one-half hours at a current corresponding to the four-hour rate of an Exide battery of the same size. The capacity is claimed to be 12.5 per cent more. The weight is about the same as that of an Exide battery of corresponding size. The chief claims made for the battery are its durability, decreased maintenance expense, a life from two to three times that of the Exide battery and a mileage life of over three times that of the latter.

The discussion following the presentation of the paper brought out a number of points regarding the construction and performance of the battery hitherto unpublished. Mr. W. P. Kennedy, of the Studebaker Automobile Company, New York, asked if the quantity of electrolyte had been increased or whether a greater area of the positive plate had been exposed, and he also desired to know if the shielding of the positive active material by means of the rubber tube had any tendency

to postpone sulphation of the positive plate. The questioner also understood that the cost of the battery was somewhat higher than the cost of a battery of equivalent type and of equivalent capacity and asked for information regarding the economy to be effected by the use of the new cell.

Mr. Ford in answering the questions said that the quantity of electrolyte used in the "Ironclad" was about the same as that used in the standard Exide battery. The positive plate, being composed of a series of pencils, exposes a greater surface than the standard plate, but inasmuch as some of the surface is covered with the rubber tube and the electrolyte has not the same access to it that it would have if the tube were not present the actual exposed surface would be about the same. Regarding sulphation, he said that, although the company could not absolutely prove it, he thought that the battery would be as free from sulphation as any battery can be whose life and activity depend upon the principle of sulphation and not on the disease of sulphation.

Regarding the question of cost, Mr. Charles Blizard, of the Electric Storage Battery Company, said that the "Ironclad" would add an increased cost of about 40 per cent to the battery. In the matter of renewals, including labor for installing a complete battery, the increase would be about 60 per cent. The cost of operation of the new battery as compared with the lead, disregarding entirely the saving to be effected by the fact that the cleaning of the "Ironclad" can be eliminated, is about 25 per cent. The figures given do not take into consideration the increased mileage obtainable from the new battery, but the cost is reduced considerably when these figures are given weight.

Mr. F. F. Sampson, of the New York Transportation Company, asked a number of questions regarding the efficiency of the new battery, the necessity for cleaning it, the life of the wood separator, the length of time the battery would maintain its increased capacity, whether the battery could be charged at a higher rate than the present Exide cell and what would be the effect of a high discharge rate. Mr. Ford in answering the questions said that the efficiency of the "Ironclad" was about the same as that of the standard Exide cell. The new battery, he said, will practically never require cleaning. The web body of the wood separator is thicker than the web of the rubber separator, and therefore it is more substantial and less liable to crack than the old separator. When in the cell it is kept away from the positive active material, which corrodes the present separator, and with the new method of mounting the wood separator it is expected that it will be much more durable and have a life at least equal to the life of the plate. Under good operating conditions the "Ironclad" plate has about two and one-half times the life of the Exide plate. The battery is of the same dimensions as the Exide cell of corresponding size, so that the rate of charge would be logically the same, but if discharged at the four-hour rate instead of the four and one-half-hour rate it will require a longer time to charge in order to compensate for the extra capacity if the ampere-hour discharge is considered. As to the effect of a high discharge rate, the speaker said that a lead battery cannot be harmed by such treatment because the action of a lead battery in that respect is self-compensating.

Mr. L. Ruprecht, of the General Vehicle Company, New York, asked whether the height of the ribs in the new cell would be the same as in the Exide cell, to which Mr. Ford answered in the affirmative. Replying to a question of Mr Cheesboro regarding the watt-hour capacity per pound, Mr. Ford said that this was about nine and one-third initially, and may be worked up from 30 per cent to 35 per cent higher, thus approximating 12 watt-hours or a little more. Replying to a question asking information as to the method of fastening the strap to the connectors, Mr. Ford said that the little lugs on the ends of the copper connectors are raised to pass over the pillar strap, and that the pillar strap is then burned down just enough to maintain the fit.

Mr. Lloyd, of the General Vehicle Company, Long Island City, said that his company addressed itself to the subject of getting satisfactory batteries for its wagons, and, of course, had to depend upon the standard plates, the medium plate and thin plate, and finally adopted a fairly thin plate. He hoped that there would be something in the new battery which will appeal to all the vehicle manufacturers and which will become standard, so that different batteries will not exist all over the country. He did not think that the "Ironclad" had any greater capacity than the thin-plate battery used by his company, nor was its internal resistance any lower or the efficiency any higher. If the "Ironclad" battery had a longer life it would appeal to his company, but if the cost is such that it just about equals his company's estimated cost of renewal for batteries to carry it over the same period he was not satisfied as to the economy of using the new battery. The battery is not any less liable to misuse than the old form of standard lead plate, and Mr. Lloyd complimented the manufacturer on the product, as he realized the great difficulty of manufacturing the rod and developing it and the rubber tube. He said that if the rods did not swell or buckle he did not see why the battery should not last a long while under ordinary circumstances. Mr. Lloyd gave some figures comparing the battery used by his company with the "Ironclad," basing his comparison on the figures brought out in the paper and discussion. He expressed the opinion that the capacity of the battery should be based on a six-hour discharge rate rather than on a four-hour basis.

Mr. Pender asked concerning the advantages of the new thin connecting strap over the older strap and the reasons for making the change. Mr. Ford pointed out that the advantages were twofold—first, that the new strap was flexible and, second, that it had a higher conductivity because it was made of copper instead of alloy. The straps were made of a size to decrease the weight of the battery per kilowatt. Moreover, inasmuch as the "Ironclad" plate is not rigid a flexible strap is necessary.

Mr. Lloyd, again taking up the question of the rate of charge and discharge, said that his company used a lower rate per plate discharge than that recommended in the paper, but for the complete cell used substantially the same rate and ran six hours, while the Exide ran four hours. This is accomplished by placing 50 per cent more plate in the battery. Mr. Ford in his reply stated that if 50 per cent more plate is placed in the same size jar the four-hour rate of each plate would become 5.61. The six positive plates would have on a six-hour basis a total of 147.6 amp-hours instead of 112 in the size of jar mentioned. He was under the impression that on the basis of each initial rating the plates mentioned by Mr. Lloyd actually gave more than their initial capacity. Mr. Lloyd said that, on the contrary, the initial capacity was very much less. His company places thirteen thin plates in an ordinary nine-plate jar.

Mr. Erskine asked Mr. Ford if the new battery would resist the action of foreign material, such as salt or saltpeter, any better than the old. Mr. Ford did not think it would, and very much preferred not to answer the question at that time.

Mr. Bartlett interrogated Mr. Ford on the life of the new plates as related to the number of charges. He wished to find out if a pleasure vehicle, for instance, ran fifteen miles and was then charged, then ran twenty miles and was charged again, and afterward ran ten miles more and was charged, whether he would be drawing from his bank account in proportion to the number of charges, or whether the plate fails by some other action and disintegration of the active material. Mr. Ford said that the overcharge would not affect the new plate as much as it would the old plate, and suggested that if care were exercised not to charge the battery fully, but to place in about as much as was taken out, reserving normal charges for bi-weekly or weekly inspections, better results would be obtained.

Mr. Lloyd expressed the hope for great improvement in the lead battery, and said that both the Edison and lead batteries are now doing good work, intimating that the Edison

battery was to be still further improved. Whatever difference of opinion there might be as to which of the two is better, he said that the industry should feel encouraged that the storage battery manufacturers were doing so much work for the electric vehicle business. Mr. Morrisse requested information on connecting and disconnecting the new connectors, and Mr. Ford said that for this purpose his company had developed a little shearing device which would shear off the strap where it was burned and that it can be easily replaced by the aid of a soldering iron.

Mr. Rice gave his experience in giving vehicle batteries partial charges at the noon hour while the operator was at lunch, but Mr. Ford was of the opinion that this procedure was a little dangerous because it was apt to be overdone. If, however, only a very small charge is given no deleterious effect should result. Mr. Lamont gave some information on the use of the ampere-hour meter on charging circuits.

It has been suggested to hold the next monthly meeting in Chicago at the time of the Chicago automobile show.

Some Principles Established by the Wisconsin Commission.

Before the convention of the Wisconsin Electrical Association at Milwaukee, Jan. 18, Mr. Edwin S. Mack, of the law firm of Miller, Mack & Fairchild, Milwaukee, presented a review of some of the principles established by the Wisconsin Railroad Commission affecting the electric lighting, railway and other public utilities of the State.

The commission has now been in service more than five years, during three years of which it has had jurisdiction over electric light companies. Its decisions and opinions occupy five printed volumes, in addition to its annual reports. Besides work of a routine character, such as the answering of questions and acting as general counsel and mentor to utilities, the duties of the commission are of two kinds: (1) The setting of standards of service, and (2) the adjustment of disputed cases and service and rate complaints.

Good service to the public is exacted by the commission, and if, upon investigation of a case, it finds an increase of rates necessary to enable good service to be rendered the commission is disposed to order such an increase. The adjustment of rate cases involves study of many factors. From the gross earnings the operating expenses including the taxes must be subtracted, while the rate of depreciation due to age and wear, the reasonableness of return, the correct principal on which to base return and the percentages allowable for interest and profit must all be determined. In addition to this costs must be properly proportioned among the various classes of service so that each of these classes shall pay its share.

The figures for the gross earnings and operating expenses are usually obtained from the company's books, verified by examination and study of the property in operation.

In considering the principal to be taken as the basis of return it is pointed out that different principles apply from those applicable to property with an open market value. The principal may be taken as the funded debt or bond issue, plus the capital stock and investments. If necessary to appraise the tangible property, (1) its original cost including additions may be considered, or (2) cost of reproduction new, or (3) present value —that is, reproduction value minus depreciation. Added into this, of course, is the "service" value, engineering, etc., necessary to make of the integral parts an efficient mechanism.

The "actual total investment" is generally taken as the basis for rate-making, when it can be shown that the expenditures have all been prudent compared with the present value of the investment and that ordinary business sagacity has been employed. When excessive or imprudent investments, not commensurate with the value of service to the customer, have been made a corresponding reduction will be ordered in the principal amount. Mr. Mack said that all values, whether gifts, surplus earnings, or new capital, are considered by the commission as actual parts of the investment. The sale of bonds is recognized by the commussion as the modern method of raising capital, and matters of bond discounts are viewed as proper items of cost.

"Cost of going value," that is, the expenditure or deficit involved before the business reaches a profitable condition, with organization perfected, customers connected and harmonious operation throughout its mechanism, is also regarded as an item of the investment. The "cost of going value" as computed by the commission is shown by the diagram accompanying, which traces the elements of the example company's business during the first year, given over to construction; the second year, when partial operation began, and the following years, during which the business expanded normally, the income finally exceeding the expenses and netting a profit.

Interest at the rate of 6 per cent or 7 per cent will be allowed on going value, the higher figure where the service is good and it can be shown that the plant was not built ahead of public needs or in an excessively expensive or unwise manner. that there are no present prospects of profits, or that the past management has not been incompetent. Obviously, according

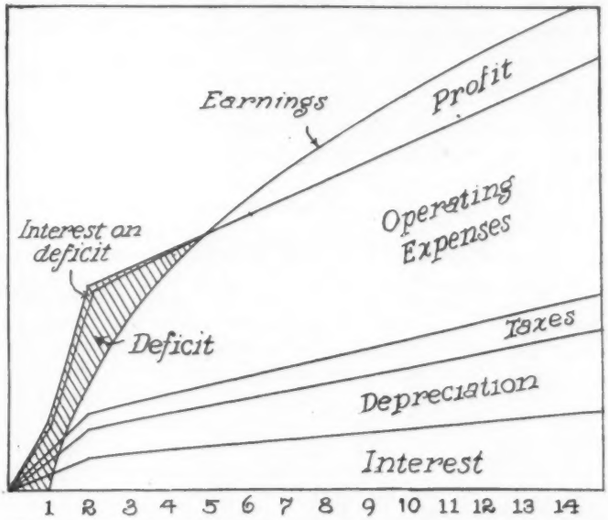


Diagram Showing Wisconsin Commission Method of Computing "Cost of Going Value."

to the commission's doctrine, public utilities cannot retrieve errors or losses as private businesses can. Of course, when a good return has been earned continuously from the beginning of work no cost of going value will be considered or allowed by the commission.

When the investment in the property is not ascertainable or it becomes necessary to check or approximate such investment recourse is had to the appraisal of the elements of the property by the valuation staff of the commission. This staff was originally formed for the Tax Commission's service, on the Michigan plan, but now serves that commission and the Railroad Commission jointly.

Added to the sum of the costs of the elements of the plant as appraised, a general allowance of 10 per cent to 12 per cent is usually made for the expenses of combining the plants in "harmonious operation." Of the usual 12 per cent allowance, which applied to all but store supplies and paving, 5 per cent is credited to engineering, 4 per cent to interest during construction and 3 per cent to legal expenses, commissions and contingencies. The Wisconsin Commission usually places this total at 10 per cent to 12 per cent, although many engineers figure 15 per cent to 20 per cent for these expenses. In addition to this percentage stores and supplies, as part of the working capital, have been allowed up to 1.5 per cent in some cases. The depreciation factors for getting present values are obtained from curve sheets issued by the commission showing various rates of depreciation applicable to elements suffering from different degrees of wear and obsolescence.

The commission has refused to place a capital value on "successful good judgment" employed in locating a site, allowing only for the amount of money actually expended in acquiring the site. Allowance is made for non-operating property held for reserve or emergency use, but not for discarded equipment, or equipment held beyond plant requirements.

"Good will" as an element of public utility value is not recognized by the commission, which takes the point of view that this intangible asset applying to a private competitive business does not hold in a public monopoly. Franchises the commission recognizes as having value, but declares that this value cannot properly be considered for rate-making purposes. The commission carefully distinguishes the elements of interest and profit, decreeing for the first a reasonable rate of return on the investment, beyond which the surplus becomes profit. The commission frequently allows 8 per cent, chiefly for electrical industries, while water companies are restricted to 7 per cent and sometimes 6 per cent. Municipal plants are limited to 4 per cent.

In Wisconsin there has been a tendency to lose sight of the parts of a business, in consideration of the whole, although this is, of course, contrary to cost distribution methods. The cost of service is generally held to control the rate to be charged, although this has been modified in the case of small customers to enable them to be served at a cost which shall not be prohibitive. So far as possible, short-hour consumers pay an amount on the fixed costs proportional to their demand, and an amount on the variable costs proportional to their consumption or hours' use.

Massachusetts Legislative Notes.

Speaker Walker, of the House, has appointed a special legislative committee to consider the recommendations of Governor Foss regarding the abolition of existing State commissions and the creation of a single public-utility board. House Chairman Grafton D. Cushing will preside over the committee's deliberations and a thorough discussion of the Massachusetts policies of corporate regulation is anticipated at its sessions. A large number of bills of interest to public-service corporations have been introduced into the Legislature. Among these are bills to prohibit or regulate charges for the furnishing of gas or electric meters; a bill making it unlawful to employ in any public telephone office or exchange between 10 p. m. and 6 a. m. a woman or girl under the age of twenty-five; a bill permitting municipalities to construct municipal lighting plants upon vote of their citizens, without the existing safeguards, and a bill requiring stock of gas and electric light companies sold at auction to be disposed of in the City of Boston to the highest bidder. Two bills have been introduced reducing the hours of labor of street and elevated-railway employees by one hour per day, with restriction of the number of hours in which a day's work is to be performed; the property interests of the West End of Boston, represented by Mr. E. D. Codman, have filed a bill for the construction of a subway under the West End from Park Street to Cambridge Street; and the Boston & Eastern Electric Railroad Company has filed a petition for legislation requiring the Railroad Commission to issue to it a certificate of public convenience and necessity, so that it can proceed to build a high-speed electric interurban railway between Boston, Lynn and Salem.

New York Commission News.

The Public Service Commission, Second District, has notified all telephone corporations within its jurisdiction that the practice of offering trial service installations is regarded by the commission as unlawful and that the company engaging in the same is subject to the forfeiture and penalties prescribed by the Public Service Commissions law. It has been brought to the attention of the commission that certain telephone corporations have heretofore been in the habit of making what is called trial-service installations, the result of such trial installations clearly giving the new subscriber free service from a telephone corporation during a certain period of time, in many cases as long as six months. The commission calls attention to the requirements of the Public Service Commissions law that no telegraph corporation or telephone corporation subject to the provisions of the law shall directly or indirectly give any free or reduced service or any free pass or frank for the transmission of messages between points in the State except to its officers, employees, agents, pensioners, surgeons, physicians, attorneys-at-law and their families, or to persons or corporations exclusively engaged in charitable and eleemosynary work, and ministers of religion, officers and employees of other telegraph corporations and telephone corporations and street-railroad corporations; and the further provision that no telephone corporation shall directly or indirectly or by any special rate, rebate, drawback or other device or method charge, demand, collect or receive from any person or corporation a greater or less compensation for any service rendered or to be rendered than it charges or receives from any other person or corporation for doing a like and contemporaneous service.

The Ithaca-Auburn Power Company has been authorized to execute and issue a first-lien trust mortgage upon all its property and rights acquired and to be acquired to secure the payment of its thirty-year 5 per cent bonds to the amount of $750,000 and to issue its common capital stock for cash at not less than the par value of $50,000. The company is authorized to issue at once bonds to the amount of $433,000, to be sold at not less than 85 and the proceeds used for the acquisition of certain property from Mr. H. C. Mandeville, of Ithaca, for $100,000; for the acquisition of material for and the construction and installation of an additional steam plant, $95,000; for the construction of its distribution line and third-rail system for the New York, Auburn & Lansing Railroad Company, $201,000. None of the stock or bonds are to be issued until certain agreements with Mr. H. C. Mandeville, the Remington Salt Company and the Ithaca Street Railway Company have been entered into and satisfactory proofs submitted to the commission.

The commission has dismissed the complaint of the trustees of the village of Salamanca against the Salamanca Gas Company as to price of natural gas for fuel and light in that village. The village has consented to the dismissal of the complaint on the company agreeing to extend its existing distribution mains within the village limits to a distance not to exceed 200 ft. upon the application of a property owner who shall agree to make the service connection and purchase gas under the rules and regulations of the company; and further that the prices charged for natural gas to consumers within the village shall at no time exceed the prices then being charged to consumers in the City of Buffalo by the Buffalo Natural Gas Company. The present rate in Salamanca is 30 cents per 1000 cu. ft.

The Public Service Commission, Second District, has authorized the Westchester Lighting Company to issue under its first mortgage dated Dec. 1, 1900, to the Colonial Trust Company its fifty-year 5 per cent bonds to the amount of $2,824,000. The bonds are to be sold for par and the proceeds used to pay off and discharge the remaining bonded debt of the New York Suburban Gas Company, amounting to $343,000, which company was merged into the Westchester Lighting Company on Dec. 1, 1900, and to pay off and discharge the indebtedness of the petitioners to the Consolidated Gas Company on certain notes. Further petition is to be made by the company later on, at which time the question of crediting the capital account of the company with the replacements which have been made will receive consideration from the commission.

The Murray Electric Light & Power Company, of Monticello, has been ordered to show cause why it should not put its plant and overhead-line system in safe condition. The Monticello Telephone Company complains that at the present time sagging wires and other defectively constructed and maintained electrical equipment are a constant source of danger to life and property, that telephones are being burned out and fires have been started in buildings in that place by reason of the unsafe condition of the wires.

Maryland Commission News.

The Public Service Commission, following a lengthy investigation, has ordered the Easton Light & Fuel Company, of Easton, Md., to make a number of substantial improvements to its plant. The officials of the company are also ordered to report to the commission on Feb. 1 next, and every two weeks thereafter, regarding the progress of the installation. The order which was passed last week is the first of its kind that the commission has framed since it was created last year. The order is the direct result of a complaint filed several months ago by the Mayor and City Council of Easton and a number of citizens of the town. The complaint alleged that the gas and electric service furnished by the Easton Light & Fuel Company was of a poor quality and relief was asked for. Last week Commissioner Laird and Chief Engineer Phelps of the commission went to Easton and made a direct investigation. Commissioner Laird heard a quantity of oral testimony and Mr. Phelps made a careful examination of both the gas and electric plants of the company. The commission decided not to act on the complaints concerning the electrical service at this time, deeming that it would be better to secure an improvement in the quality and service of the gas furnished to the patrons at once. The commission's orders regarding the improvements were based on a report filed by Engineer Phelps. The order says that the commission has decided from the report of the chief engineer and from the evidence submitted that public convenience requires immediate improvement in the physical conditions of the works and an improvement in the methods of manufacturing the gas as supplied to patrons. The company was ordered to make the improvements suggested by Mr. Phelps. The first of these is that the plant shall have a thorough and immediate cleaning up. A number of technical recommendations were also made by the chief engineer.

Positive assurances were given last week by Mayor Mahool that on or about the first of next month the City of Baltimore will be in a position to lay before the commission its formal complaint against the general commercial rates charged by the Consolidated Gas, Electric Light & Power Company for gas and electric service and its application for the adoption of the London sliding scale plan in the future regulation of the company's rates. The commission was advised as far back as last June that such a complaint would be filed, and it was announced at its offices last week that the commission was prepared to receive the city's case. As soon as the complaint is filed a copy of it will be served on the company and the case will proceed without any delay.

In accordance with an order issued some time ago the Chesapeake & Potomac Telephone Company last week filed with the Utilities Commission a report showing that it owns in the State of Maryland property having a book value of $8,338,554 and an estimated value of $8,452,600. These figures, according to the report, do not include the value of the company's easements, which the city officials, for the purpose of taxation, fixed last year at $594,067. Using the company's estimated values, its property located in Baltimore is no less than $5,415,000, while its holdings in Maryland outside of the City of Baltimore are worth $2,922,000. To this is added a list of miscellaneous property, such as stores and supplies, teams, tools, furniture, fixtures and the like, allotted to both Baltimore and Maryland, which has a value of $115,000, making up the total of $8,452,000. In itemizing its property the company estimates the value of its land and buildings in Baltimore City at $811,000 and its city exchange equipment at $1,204,000, while its country exchange equipment is set down as $150,000. The values of other items are: Subscribers' equipment, city, $777,000, country, $263,000; underground conduits, city, $860,000, country, $97,000; poles and lines, city, $180,000, country, $1,143,000; underground cables, city, $939,000, country, $104,000; interior blocks and distributing wires, city, $170,000, country, $108,000; aerial wires, city, copper, $177,000, country, copper, $522,000, iron, $137,000; aerial cable, city, $273,000, country, $274,000; rights of way, city, $30,000, country, $61,000. The information contained in the report was requested by the Public Service Commission for the purpose of enabling it to determine the reasonableness of the new schedule of rates which the company is seeking permission to put into effect.

Massachusetts Commission News.

After an exhaustive investigation extending through several months the Massachusetts Gas & Electric Light Commission has reached the conclusion that it is at present inadvisable to recommend legislation on behalf of granting the right of eminent domain to electric power transmission companies within the State. The granting of eminent-domain rights was opposed in many quarters, notably by the Massachusetts Electric Lighting Association. In brief, the commission recognizes the necessity of constructing transmission lines on private rights-of-way. It is convinced of the importance of encouraging the entrance of cheap energy, but nevertheless feels that the framing of a bill which shall be constitutional and practical is a matter of great difficulty. It points out that any authoriuty to condemn land for private rights-of-way must be granted under adequate safeguards for the protection of the rights of the communities and individuals over whose territory such lines must pass, and that the public character of the undertaking should be clearly established as a condition precedent to any exercise of the right. The commission admits that the time may not be distant when the proper development of electrical distribution will require the exercise of eminent domain, but it feels that the need is not so urgent as to justify it in proposing a bill for that purpose at the present time. It therefore recommends that such legislation be postponed until experience more clearly demonstrates the need to exercise the right and discloses the character and intent of the public interests involved. A number of subordinate matters are treated in the report, which recommends legislation amending various sections of the Revised Laws bearing upon the marking of poles and wires, the location of lines across and under public ways, the location of wires belonging to street and electric railway companies, the marking of poles carrying dangerous potentials, the approval of interurban electric line regulations by the board and the recommendation that the board may grant a location for a line for the transmission of electrical energy which must pass through one or more cities or towns to connect its proposed terminals in case of the refusal or neglect of the municipal authorities through whose city or town the line is to pass to grant a location therefor, to provide for the confirmation of locations for electric lines in public ways which have been expressly granted by the proper authorities and are in actual use by the grantees, and to provide for the establishment of underground districts and for requiring the placing of all wires in such districts below the surface.

The commission has approved the issue by the Lynn Gas & Electric Company of 1800 shares of new capital stock at the price of $235 per share, as determined by the directors. The proceeds of 120 shares are to be devoted to the payment and cancellation of bonds of the par value of $10,000 issued by the Marblehead Gas & Electric Light Company and other indebtedness of that company amounting to $18,200, the payment of all these bonds and debt having been assumed by the Lynn company in connection with its purchase of the former; the proceeds of 540 shares are to be applied to obligations of the Lynn company on account of plant improvements; the proceeds of 180 shares are to be applied to the meeting of obligations incurred in the improvement of the Marblehead plant, and the proceeds of 960 shares are to be applied to further plant additions. The Fall River Gas Works Company has applied to the board for authority to issue 1150 shares of additional stock at $225 per share to meet the cost of plant enlargements. The Worcester Gas Light Company has petitioned the board for authority to issue 2000 shares of new stock at the price of $200 per share, to meet the cost of plant additions and improvements. The Haverhill Gas Company, a Stone & Webster

organization, has petitioned the commission for authority to issue 5000 shares of common and 4000 shares of preferred stock of the par value of $100 each, at the price of $100 per share, for the acquisition of the property of the Haverhill Gas Light Company. The preferred stock is to be 5 per cent cumulative and preferred in liquidation.

The Massachusetts Highway Commission has submitted its annual report to the Legislature covering the year ended Nov. 30, 1910. An exhaustive discussion of the recent telephone investigations and recommendations of the board in regard to rates is included, with the usual statistics of operation from telephone, telegraph and cable companies in the State, which are now under the commission's supervision. The figures filed by the board from the returns of the companies show that the number of telephone subscribers has increased from 218,642 in 1909 to 243,779 in 1910 in Massachusetts; the number of operators from 3423 to 3566; the number of pay stations from 6653 to 7159; gross receipts from $9,999,459 to $11,088,885; net earnings from $2,633,020 to $3,115,251; the underground-cable installation from 7,288,549 ft. to 7,750,912 ft.; overhead iron wire from 40,315 miles to 51,165 miles, and the copper wire from 132,695 miles to 164,832 miles. The demand for telephone service is increasing at a very rapid rate in the State. Reviewing its action upon the rates of the New England Telephone & Telegraph Company the board shows that the old rates were disproportionate and unequal; that a reduction of revenue is fair to the company; that subscribers receiving service should be compelled to pay for the amount of service received, and that the new rates will benefit the subscribers, distribute the charges more equitably and through the use of the zone system be fair to the company and the consumer alike. The main effort was to secure equalization of rates, and the commission points out that the changes recommended were essentially readjustments rather than reductions. The commission feels that the rates compare favorably with those elsewhere, the measured business rate being in general higher in other cities. The toll rates are especially favorable at Boston. The commission recognizes that sufficient time must elapse to allow the new rates to be understood in view of the large number of subscribers affected. Already over 34,215 old subscribers, out of a total of about 75,000, have voluntarily changed to the new rates, which the commission feels is a good indication that they are favorable to the vast majority, since a total of 52,073 subscribers have expressed themselves in favor of the new rates. Over 6751 new subscribers to the new rates have been signed. The commission states that it considers the recommended rates more or less tentative, and purposes to continue its studies of the telephone situation, being open to further changes so far as they may be found necessary or desirable.

Wisconsin Commission News.

As a result of service inspections six electric light and gas companies in the State have been notified by the commission that they must immediately comply with the rules of the commission regarding service, according to the standards adopted by the commission, or legal proceedings will be taken against them. The companies are the Mineral Point Electric Light Company, Eagle River Light & Water Company, Dodgeville Electric Light & Power Company, Mauston Service Company and the Janesville Electric Company. Penalty for failure to comply with the order of the commission in this respect is fixed by statute at $100 to $1,000.

The Eleva Farmers' Telephone Company petitioned the commission for authority to put into effect a rate of $11 per year for party-line service and a rate of $14 per year for business and single-line service. Upon an investigation of the financial affairs of the company the commission allowed the rate for party-line service, but deducted $1 from the proposed rate for business and single-party service.

The commission has received a request from the Black River Falls municipal plant for an investigation of the situation in Black River Falls with special reference to the advisability of establishing a day service. The commission is requested also to recommend a schedule of rates for lamps and motors.

The Washburn City Council and the Washburn Electric Light Company have agreed to submit to the commission for its recommendation two propositions made by the company to the city concerning the rates for the lighting of the streets in the City of Washburn. Because of the fact that the city and company could not agree upon a rate for such service the streets of the city have been unlighted for more than a year. The company proposes two schedules as follows: To furnish fifty 100-watt tungsten lamps, burning 2190 hours per year, for $1,137 per year, provided the city contract for a period of ten years; or to furnish electricity for any number of lamps the city may wish to install at the following rates: Two hours' use per day, 10 cents per kw-hour; four hours' use, 9 cents; five hours' use, 8.4 cents; six hours' use, 8 cents.

Upon request of the Brodhead Electric Company the commission has analyzed the affairs of the company and recommended the following schedule of rates:

Flat Rates.

Forty cents per active lamp per month for lamps burning to midnight or later.

Twenty cents per active lamp per month for all others.

Meter Rates.

Ten cents per kw-hour for the first thirty hours' use per month of the active connected load.

Eight cents per kw-hour for excess.

Motor-Service Rates.

Seven cents per kw-hour per month for the first thirty hours' use per month of the active connected load.

Five cents per kw-hour for all excess.

The commission suggests a minimum bill of 50 cents per month for all consumers on a meter basis and $1 per horsepower per month for motors connected, with a 5 per cent discount on all bills for prompt payment.

AMERICAN ELECTRICAL ENGINEERS—No. XXVII.

L. C. Marburg.

Louis Christian Marburg was born March 8, 1876, at Wiesbaden, Germany, where his father, an American citizen, was residing at the time. He was graduated from the Gymnasium at Wiesbaden in 1894 and the same year entered the works of Sulzer Brothers, of Winterthur, Switzerland, the well-known engine builders. Commencing in one of the plants as an apprentice and successively passing through the different departments of the large factory, he soon learned the rudiments of the practical side of the profession he expected to follow and became acquainted with the shop methods of an establishment standing, according to the opinion of many European engineers, at the head of the manufacturing industry abroad. After a year's experience of this character he became connected with the Allgemeine Elektricitäts Gesellschaft, of Berlin, where he was employed as an assistant in electrical installation work of various kinds.

In the fall of 1895 Mr. Marburg entered the Technical High School of Charlottenburg, choosing as his particular study the course in electrical engineering, and a year later went to the Technical High School of Hanover and finally to that of Darmstadt. Among the professors at these colleges at the time were Riedler, Kohlrausch, Kittler, Guthermuth and others prominent in scientific and practical work. During his various college vacations he was employed in the experimental departments of Siemens & Halske, of Berlin, assisting in the testing of standard machines and in a good deal of research work carried on by the company.

In 1898 Mr. Marburg came to America and at once secured a position with the Sprague Electric Company, becoming in this manner connected with the pioneer work of Mr. Frank J.

Sprague in installing the multiple-unit system on the South Side Elevated Railway in Chicago. In 1900 he went to Schenectady, where he remained for over four years, being attached to the railway department of the General Electric Company, and assisting at first in the design of railway motors and later devoting his time mainly to power-station design. Among the large amount of work of this character carried on by the General Electric Company at that time were the stations of the Fonda, Johnstown & Gloversville Railway and the Schenectady substation of the Schenectady Railway Company.

In 1904 Mr. Marburg joined the Allis-Chalmers Company, remaining with it in the electrical department at Cincinnati for about one year and a half, looking after the sale of power plant and car equipment and supervising the design of a number of installations put in by the Bullock Company, which previously had been absorbed by the Milwaukee company. In 1905 he was transferred to Milwaukee to join the Allis-

L. C. Marburg.

Chalmers Company contracting department, which contracted for and supervised the installation of complete power-plant and railway equipments. Soon after this he was appointed engineer of the department and placed in charge of its engineering work.

Among the power-plant designs originating during this period under his supervision are the stations of the Toledo, Port Clinton & Lake Side Railway; the Sandusky, Norwalk & Mansfield Railway; the Indianapolis, New Castle & Toledo Railway; the electrical parts of the high-pressure fire-service stations in New York, and a number of other steam-driven and water-power stations in various parts of the country. In 1907, when the department was discontinued, Mr. Marburg was appointed mechanical engineer of the gas and mill-engine department, in which position he was in close contact for more than a year with the Allis-Chalmers Company's interesting gas-engine installations at the Illinois Steel Company's plant at South Chicago, the Indiana Steel Company's plant at Gary, etc. To the question of parallel operation of gas-engine-driven alternators he devoted a great deal of attention, making a special study of it during a trip abroad. In 1908 Mr. Marburg was placed in charge of electric hoisting work, another subject to which he had devoted a great deal of time during a European trip.

Mr. Marburg is now secretary and treasurer of Marburg Brothers, engineers and importers, New York, a corporation formed during the past year to import various specialties from Europe and to represent European inventors in the exploitation of their patents in this country.

For some time Mr. Marburg was among the special contributors to the *Elektrische Kraftbetriebe und Bahnen*, of Berlin. A number of patents have been issued in Mr. Marburg's name covering various electrical improvements in connection with power distribution.

Mr. Marburg is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, New York Electrical Society, Verein Deutscher Ingenieure of Germany, and the Electrical Society of Berlin. He is also a member of the Engineers' Club of New York and the University Club of Milwaukee.

CURRENT NEWS AND NOTES.

Commission Plan of Government for Illinois Cities.—Decatur, Ottawa and Dixon, by a special election in each case, have been added to the list of Illinois cities adopting the commission form of government made permissible by a recent law of the Illinois Legislature.

Expensive Coal for Municipal Plant.—The *Illinois State Register* charges irregularities in the conduct of the city finances of Springfield, Ill., among others, that an item of $1,164.48 due for coal for the municipal lighting plant in January, 1908, was paid three times; first on Feb. 29, 1908, next on April 14, 1908, and again on Jan. 2, 1909. The coal company declares that the last check was the only one which passed into its hands.

City Electrical Inspector for Milwaukee.—Alderman Koch, of the Milwaukee City Council, has introduced an ordinance, now passed to its third reading, providing for a city electrical inspector and three assistants to supervise all wiring and apparatus installed, enforcing the National Electrical Code standard. Wiring supervision in Milwaukee is now handled by the Underwriters' inspector, who works independently of the city ordinances. The new city inspector will be appointed for a term of four years.

Fatal Boiler Explosion at Rushville, Mo.—A boiler explosion in the electric-light plant at Rushville, Mo., on Jan. 14 is reported to have wrecked the station, killing two men who were in the boiler-room. Pieces of machinery were blown through the home of Mr. C. L. Smith, owner of the electric plant, partially demolishing the residence. The force of the explosion shook the whole town and broke many windows. The Rushville plant has been established six years and the boiler which exploded has been in use during that period.

Illinois Electric Railways Association.—Temporary organization of the Illinois Electric Railways Association was effected at a meeting of representatives of about twenty Illinois electric railway companies in Chicago on Jan. 19. Mr. H. E. Chubbock, Illinois Traction System, Peoria, was elected temporary president and Mr. C. E. Flanner, auditor of the Aurora, Elgin & Chicago Railroad Company, Chicago, temporary secretary. Various committees were appointed and the meeting adjourned until Feb. 17, when a permanent organization will undoubtedly be effected. Representatives of the Central Electric Railway Association of Ohio and Indiana were present to ask the new association to affiliate itself with the older organization, but this matter was referred to a committee without definite action.

Marine Electrical Association.—The regular quarterly meeting of the Maine Electrical Association will be held at Augusta, Maine, Friday, Jan. 27. Mr. W. S. Wyman, Waterville, is secretary.

The Wisconsin State Telephone Association.—The Wisconsin State Telephone Association will hold its annual meeting and convention at Madison, Wis., on Feb. 1 and 2. Provision will be made for the display of commercial apparatus and material. Mr. P. J. Weirich, Monroe, Wis., is secretary.

A Porter's Philanthropy.—James H. Tilghman, a colored porter in charge of the clubroom of the Chicago Telephone Company, has given $1,000 to the fund for a Y. M. C. A. building for negroes in Chicago. This is the largest gift from a negro and is believed to represent practically all the savings of the donor, who is advanced in years.

Hydroelectric Development in Finland.—An English syndicate has filed application with the Finnish Senate for a concession to use the waters of the Sarina Lake for electrical generating purposes. The concessionnaires purpose to electrify the Finnish railways and to supply St. Petersburg and Helsingfors with electrical energy. The generating station will be erected at Kuurmanjoki and will have a capacity of 168,000 hp.

Proposed Extension of "Eminent Domain" in California.—To enable the City of Los Angeles to condemn the plants of private water and water-power companies and acquire them for public use, Senator L. R. Hewitt, of the California Legislature, is preparing to introduce a bill amending the law of eminent domain for that purpose. If the bill becomes a law the city may go into the courts and secure an appraisement of a reasonable price to be paid for the private plants, and may then acquire them upon payment of the fixed price.

Excursion of the Boston Section of N. E. L. A.—On the afternoon of Jan. 14 the Boston Edison Section of the National Electric Light Association met at the Edison Library and visited the United States Navy Yard at Charlestown, where courtesies were extended by the government. Four officers were detailed to show the party the most interesting features of the yard, including the chain and rope shops, power plant and electrically driven dry-dock pumping plant, the boat shop and the battleship *New Jersey*, which is at present undergoing repairs. Many points of interest ordinarily missed by visitors were pointed out and the section voted the excursion one of the most successful in its history.

Gas Fatalities in Chicago.—An unusually large number of accidents due to the escape of illuminating gas have been reported from Chicago within the last two or three weeks. In every case the accident would not have occurred if electricity had been used. In addition to instances which have been mentioned previously in this journal, the case is related of a woman who walked in her sleep and turned on the gas in her room without lighting it, being overcome by the fumes. The woman was rescued in time to save her life. Another instance was that of a peddler who was found dead in his home beside his wife, who was unconscious. Gas escaping from a stove, and unsuspected, was the cause of this accident. Both victims were discovered sitting in chairs.

Chicago Stockyards Fire.—During the inquest held over the victims of the disastrous fire in the refrigerating plant of Morris & Company, Chicago Union Stockyards, on Dec. 22, testimony was given to show that the electrical wiring in the building was not maintained up to a proper standard. There was some suspicion that the fire might have been of electrical origin, but the coroner's jury in its verdict says that it is unable to determine definitely the cause. No reference is made in the findings of the jury to the electrical equipment, except that it is recommended that a thorough re-inspection of the stockyards be made by the city building and electrical departments and any violations of the ordinances be corrected immediately.

Sons of Jove Initiation in Chicago.—Taking advantage of the occasion of the Chicago Electrical Show, the Sons of Jove gave a dinner, followed by a rejuvenation, at the Auditorium Hotel, Chicago, on Jan. 17. Messrs. Frederic P. Vose and A. A. Gray were the toastmasters at the dinner, the former introducing the proceedings with a thoughtful speech on the deeper significance of Jovianism that made a lasting impression. Brief remarks were made after dinner was over by Messrs. F. S. Hunting, of Fort Wayne; W. N. Matthews, of St. Louis; David Aitken, of Cleveland; Glenn C. Webster, of Cleveland; W. H. Colman, George S. Searing, R. M. Van Vleet, George H. Porter, W. A. Stacy, Frank L. Perry, M. L. Womack, James C. Pomeroy and P. R. Boole, of Chicago. A class of forty-two candidates was initiated with dignified ceremony and a message was sent to Mr. J. F. Dostal, of Denver, the reigning Jupiter, who was unable to be present. Mr. Dostal and Mr. J. Robert Crouse, of Cleveland, past Jupiter, sent messages of regret.

Officers Nominated for Electric Club of Chicago.—At the meeting of the Electric Club of Chicago on Jan. 18 a vote of thanks was extended to the McGraw Publishing Company, publisher of the *Electrical World*, for supplying to the club, with its compliments, 1000 copies of a pamphlet containing the constitution and by-laws and list of members. The question of recommending a system of co-operative daily newspaper advertising in Chicago, such as obtains in Cleveland, was referred to the board of managers for future action. The nominating committee, through Mr. F. S. Hickok, made its report and the following gentlemen were placed in nomination and will undoubtedly be elected at the annual meeting of Feb. 1, as there is no sign of an opposition ticket: President, Homer E. Niesz, Cosmopolitan Electric Company; vice-president, Charles A. Howe, Holophane Company; treasurer, Otis B. Duncan, the J. Lang Electric Company; secretary, N. F. Obright, Sanitary District; board of managers, John W. Mabbs, chief engineer Board of Trade; H. A. Mott, Chicago Telephone Company; A. L. Millard, Westinghouse Electric & Manufacturing Company; George H. Jones, Commonwealth Edison Company, and W. R. Bonham, Sterling Electrical Manufacturing Company. Mr. H. D. Critchfield, of the Automatic Electric Company, gave an address on the automatic telephone exchange service in Chicago.

Peculiar Central-Station Accident at Plymouth, Mass.—A curious shut-down lasting about ten minutes was recently experienced by the Plymouth (Mass.) Electric Light Company. On the back of the main switchboard at the Leyden Street plant are several oil switches of the type which have the terminals brought out of the top of the switch through porcelain insulators and then connected with the busbar, machine or line through a right and left brass coupling which makes a bare brass connection 3 in. long in the top of the switch. This connection passes through the porcelain at the top of the switch for about 1½ in. and the brass coupling is covered by a paper sleeve which is slipped on over the wire and which fits down tightly over the porcelain. A short-circuit took place on a switch of this type, the switch being connected to a machine which was not in operation. The short-circuit occurred on the bus side of the switch, which was alive. Sand was thrown on the switch to extinguish a fire which started in the paper sleeve, and a mouse was found between the two connections, apparently electrocuted. It appeared probable that the mouse had formed a cross connection with its tail or claws between the opposite poles of the switch and it was evident that in some way the paper sleeves had become worked up enough to expose the circuit to the mouse's body. The insulation of the wire leading to the busbars did not burn, as it was of the fireproof type.

Terminal Electrification in Chicago.—In its annual report the executive committee of the Chicago Association of Commerce relates the efforts made by the association, through a committee of engineers of prominence, to make a study of the feasibility of electrifying the steam-railroad terminals in Chicago. It is promised that the investigation shall continue during the year 1911 and that a conservative analysis of the whole subject will be undertaken.

New Element Has Diamagnetic Properties.—Celtium is the name of a newly discovered element reported by Mr. Urbain to the French Academy of Sciences. The new element was isolated during attempts to obtain another comparatively new material, lutenium, which Mr. Urbain is reported to have discovered two years ago. Celtium is a product of the gadolinite earths and is said to have diamagnetic properties three or four times those of lutetium.

N. E. L. A. Hotel Committee.—For the accommodation of members who expect to attend the next convention of the National Electric Light Association, which, as announced in these columns last week, will be held in New York City, May 29 to June 3, a hotel committee, headed by Mr. F. H. Smith, of the United Electric Light & Power Company, New York City, has been formed. This committee will undertake to make definite hotel reservations for members and their guests on application.

More Than Fifty-seven Varieties.—A manufacturer of small alternating-current motors displayed a card at the recent Chicago Electrical Show stating that he had 1288 different types from which selection might be made. This large number is due to the different sizes, speeds, voltages, phases and frequencies, the varying characteristics interlacing in such a manner as to increase the number of "types" in geometrical ratio. This manufacturer makes motors from 1/6 hp to 10 hp. The number of varieties where larger motors are made would be much greater, of course.

Patent Litigation.—Mr. Frank Keiper, of the New York Bar, in discussing in a recent paper the subject of patent rights, said that not more than one-third of the patents litigated are held to be valid and infringed, the other two-thirds failing to be sustained. He also believes that where one patent is sustained as valid and infringed fully fifteen patent suits are filed and dismissed for want of prosecution, owing to the trouble or expense, or both, of getting the case to a final issue. This showing, he adds, is very discouraging and indicates that a patent condition exists which needs an extraordinary remedy.

Rate Controversy in Indianapolis.—Alleged discrimination in electric light rates is a subject being agitated in Indianapolis (Ind.) and has led to the holding of meetings by consumers and refusals to pay a rate exceeding that paid by what are claimed to be favored consumers. It is urged that the State of Indiana shall file a claim for $35,000, representing the difference between the rate charged the State for lighting the State House and other public buildings and that charged other patrons by the same company. The Indianapolis Board of Public Works has ordered the lighting companies to file a schedule of rates, and it is proposed that patrons shall refuse to pay their lighting bills until the companies file a scedule of rates and shall go into court if the supply is shut off.

N. E. L. A. Philadelphia Section Meeting.—At a meeting of the Philadelphia Electric Company Section of the National Electric Light Association held on Jan. 16, 1911, Mr. G. Bertram Regar, of the Welsbach Company, presented a paper on incandescent gas lighting which proved of much interest to the electrical men. Among the speakers of the evening were Mr. W. W. Freeman, president of the National Electric Light Association, and Mr. T. C. Martin, the general secretary; Mr. R. S. Orr, vice-president of the Pennsylvania Electric Association; Mr. E. A. Baily, chairman of the Brooklyn Company Section of the N. E. L. A., and Mr. M. S. Seelman, Jr., editor of the N. E. L. A. "Question Box." The meeting developed into an N. E. L. A. rally and was of special interest to the section. There were in attendance 181 guests and members.

One Hundred and Ten Thousand Volt Plant in Germany.—The first transmission line in Europe utilizing an e.m.f. as high as 110,000 volts will be built at Gröba, Germany, by the Aktiengesellschaft Lauchhammer. This company owns a large number of iron and steel works, some of which are to be furnished with electrical energy from the new power station. Three turbo-generators, each one of 5000 kw, will be installed at first, with space provided for two of the same size to be installed later. Four three-phase, oil-cooled transformers will step up the generator voltage from 5500 volts to 110,000 volts. The energy will be transmitted by overhead lines a distance of about thirty-five miles. When completed the station will have a total output of 50,000 hp. The transformer and switchboard installations are to be made by the Siemens-Schuckert Werke in Berlin.

Navigability of the Desplaines River.—Many interesting historical facts are brought out in the suit of the United States government against the Economy Light & Power Company, of Joliet, Ill., to restrain the latter from obstructing the navigation of the Desplaines River by constructing a water-power dam at Dresden Heights. The Supreme Court of Illinois has decided that the Desplaines River is not to be considered as navigable, as the rights of the water-power company go back to the time before the water of the Chicago Drainage Canal was turned into it. The government has taken the opposite position, however, and testimony is being taken in Chicago. One witness was Mr. Reuben G. Thwaites, of Madison, Wis., for twenty-four years secretary of the Wisconsin Historical Society, who testified that historical documents show that nearly a century ago boats capable of carrying six tons of merchandise and a crew of five men were able to navigate the Desplaines River without difficulty.

Electric Iron and Steel Works in Norway.—The Arendals Power Company of Norway, which for many years has owned the large waterfalls Böilefossen, will take up the electrical manufacture of iron, having acquired a considerable area of land for that purpose. The company has increased its capital to $1,000,000. Stock will be issued to the amount of $550,000 and $500,000 will be obtained from banks. The Böilefossen waterfalls at average flow will develop 30,000 hp, and with some hydraulic development will give an additional 12,000 hp. The company also owns practically the whole mining district about the City of Arendal. Recently it acquired the right to use the patents owned by the Swedish Electrometal Company for producing iron and steel by means of electricity. The methods involved in these patents have been thoroughly tested at Trollhättan in Sweden and at Hardanger in Norway. The new works will be ready for operation in January, 1913.

Telephone Rate Investigation in Chicago.—The investigation of the telephone rate question in Chicago was continued last week by the City Council committee on gas, oil and electric light. The Chicago Telephone Company continued to resist the conclusions of Mr. Hagenah, the city's expert. Many alleged erroneous deductions in the Hagenah report were pointed out by the representatives of the company. For one thing, it was declared that no provision had been made to give the employees of the company an increase in pay during the next five years, notwithstanding the increasing cost of labor. The apportionment of charges to be made for toll service between the local company and the long-distance company was also discussed. It was asserted that of a long-distance charge amounting to $5, the local company gets about 12 cents, and the Aldermen wonder whether that is enough. The question of a reasonable dividend, whether 7, 8 or 10 per cent, and the rate

of depreciation, whether 5½ per cent, as recommended by Mr. Hagenah, or 7 or 8 per cent, as desired by the company, was discussed. The committee itself is not a unit in considering the rate question, and no conclusion had been reached at the end of the week.

Tests of Meters.—Of 7713 tests of electric meters reported to the New York Public Service Commission, Second District, during November, 1910, 6188 meters, or 80.23 per cent, were accurate; 402, or 5.21 per cent, were fast, and 1123, or 14.56 per cent, were slow.

Empire State Association to Meet.—An informal meeting of the Empire State Gas & Electric Association will be held on Feb. 1 at Binghamton, N. Y. No specific subjects for discussion have been assigned in advance of the meeting, but topics of interest will be taken up.

Perpetual Franchises in Indiana.—A bill has been introduced in the Legislature providing that no public-service company shall assert a perpetual franchise. The bill is understood to be aimed to prevent the Indianapolis Water Company and the Central Union Telephone Company from asserting a perpetual franchise.

Mme. Curie Defeated.—The French Academy of Sciences has elected M. Edouard Branly to a vacancy in that body by thirty votes against twenty-eight for Mme. Curie, who was a candidate for the chair, which was formerly occupied by her husband. M. Branly discovered the coherer which led to the development of wireless telegraphy.

Baltimore A. I. E. E. Section.—At a meeting on Friday, Jan. 20, of the Baltimore section of the American Institute of Electrical Engineers, Dr. J. B. Whitehead, of Johns Hopkins University, presented a paper on "The Influence of the Magnetic Field on Vision," and Mr. A. S. Loizeaux another on "The Characteristics and Operation of Relays for Tripping Coils."

Change in the Value of the International Volt.—The Bureau of Standards, Washington, D. C., has issued in Circular No. 29 a statement that since Jan. 1, 1911, the bureau has been using as the e.m.f. of the Weston normal cell 1.01830 international volts at 20 deg. C. The change made is equivalent to an increase of about 0.08 per cent in the value of the international volt. Detailed explanations are given as to the reasons for making the change.

Industrial Safety Association.—Steps are being taken toward the formation of a National Industrial Safety Association along the lines of national engineering societies. Among the objects of the association will be to support a propaganda concerning the means of safety, by illustrated lectures and talks in industrial works, and to collect models and photographs. Further information may be obtained by addressing the association, Engineering Societies Building, 29 West Thirty-ninth Street, New York.

Meeting of New York Electrical Society.—Dr. Percival Lowell will be the speaker at a meeting of the New York Electrical Society, to be held in the Engineering Societies Building, New York, on Feb. 2, 1911. The subject will be "World Evolution." The lecture will be profusely illustrated by lantern slides. The lecture should prove of considerable general interest. Invitations to attend the meeting are being extended to friends of the members of the society and to members of kindred organizations.

Proposed Texas Legislation.—Among bills introduced in the Texas Legislature is one ordering an investigation of "electrical trusts," under which term are included the Western Union and Bell Telephone Companies, electrical property syndicates not having headquarters in the State and outside electrical manufacturing companies selling their product in the State. Another provides for a public service commission and still another confers authority on municipalities to regulate public utility rates, provided that no rate shall be fixed which will not yield a return of at least 10 per cent per annum on the physical valuation of a property.

Colorado Electric Club.—At the Thursday luncheon last week of the Colorado Electric Club Mr. W. P. Carstarphen, Jr., of the Carstarphen Electric Company, assumed the presidency for the ensuing year and gave an interesting address outlining the purpose of the organization. He emphasized the educational as well as the social features and proposed a greater participation by members in weekly addresses. The speaker of the day was Mr. H. H. Rice, who was introduced by Mr. Greenawalt, and as a subject took "Concrete and Its Use in Building Construction." The address was followed by comments from representatives among club members of the Portland cement manufacturers. A short statement on the reduction of fire-waste incident to the more general use of reinforced concrete was made by Mr. W. J. Canada, of the Rocky Mountain Fire Underwriters' Association.

Contractors and Central-Station Competition.—The electrical contractors and dealers of Baltimore have protested to the president of the Consolidated Gas, Electric Light & Power Company against the policy of that company with respect to electrical retail trade. It was stated that this policy tends to discourage the electrical dealers from pushing the sale of electrical devices. In reply Mr. Herbert A. Wagner, vice-president and head of the electrical department, said that the company had gone into the business of wiring houses, selling electrical appliances and constructing electric signs for the reason that the Baltimore jobbers do not do these things on a sufficiently large scale to increase appreciably the sale of electric energy. "But one-third of the business originated by its advertising campaign is done by the jobbers," Mr. Wagner said. "Having an established price per lamp in each classification, the jobber knows just what our price will be for a given house. When the owner comes to him to have it wired, if it so happens that the jobber can cut under our price and make a profit he will do it. The result is that the jobbers get the cream of the business anyway. We have tried to get jobbers to unite and do the electrical business of Baltimore in a broad way, but it seems to be impossible."

Mr. F. R. Upton Entertained in Budapest.—Mr. and Mrs. Etienne de Fodor gave a dinner at the Grand Hotel Hungaria in Budapest on Jan. 5 in honor of Mr. and Mrs. Francis R. Upton, of Orange, N. J. Mr. Upton, who is accompanied by his wife and two daughters, went abroad for a two-months recreation trip and diverged from the route originally laid out to pay a visit to Messrs. de Fodor and Francis Jehl, who thirty years ago were colleagues of Mr. Upton in the Edison laboratory. Mr. de Fodor related an anecdote concerning Martin Force, who was an all-around handy man at the Menlo Park laboratory and was sent to help Mr. Batchelor to fit up the Edison lamp factory at Ivry-sur-Seine. On several occasions Mr. Batchelor tried to impress upon "Mart," as he was called, the necessity of being polite and obliging in his intercourse with Frenchmen. On one occasion Mr. Batchelor spoke to him of the use of the term "s'il vous plait" and asked how he would act if, for instance—pointing to an open door—a young lady should politely request him to close it. "Do it yourself s'il vous plait," blurted out Mart. After this time Mart was given up as incorrigible. On Jan. 6 Mr. Upton visited the large substation of the Budapest General Electric Company and was very much impressed with its extremely modern character and congratulated Mr. de Fodor upon his work. In the evening the party were taken to the Kings Theater to witness a Hungarian light opera and the following day they left for Vienna.

STORAGE-BATTERY SUBSTATION FOR DETROIT RIVER TUNNEL ELECTRIC RAILWAY INSTALLATION.

ONE of the most interesting features of the equipment installed for supplying energy to the electric locomotives operated through the Detroit River tunnel between Detroit, Mich., and Windsor, Ontario, is the substation which receives the energy at 4400 volts, three-phase, from the system of the Detroit Edison Company and delivers 650-volt direct-current energy to the electrical installation of the Michigan Central Railroad, the locomotives of which were described in our issue dated June 17, 1909.

The energy is purchased on a maximum-demand as well as a kw-hour basis, which makes it necessary for economical operation to eliminate as far as possible excessive peaks from the incoming lines. A storage battery has been installed to take care of the fluctuations of load, and the regulation devices are such that the first 800 amp are taken from motor-generator sets; then the battery takes care of the load from 800 amp up to 8360 amp; that is, the battery takes 7560 amp. Anything above this figure is again taken from the motor-generators. The maximum load is 9100 amp. When this load is being carried the motor-generator sets would be delivering 1540 amp (their full-load rating) and the battery would be supplying 7560 amp.

The more important items of apparatus installed for traction purposes only are two horizontal 1000-kw, 514-r.p.m. synchronous motor-generator sets; one 50-kw motor-generator set, and a storage battery with a present eight-hour discharge rating of 630 amp.

Each large motor-generator set consists of a General Electric three-phase, fourteen-pole, 1060-kw, 4400-volt synchronous motor directly connected to a 1000-kw, eight-pole, 650-volt direct-current generator. The pair of machines forming a two-bearing set are mounted on a common base and run at a speed of 514 r.p.m. The shaft is extended at the motor end to accommodate a direct-connected exciter. Tests show that the synchronous motors of these sets will come up to synchronism in about forty-five seconds on the 35 per cent tap of the auto-transformer starter. The guarantees provide that these machines shall operate continuously with a temperature rise not exceeding 35 deg. C. at unity power-factor and that they shall carry an overload of 50 per cent for two hours with a temperature rise not exceeding 55 deg. C. The efficiencies are as follows:

Half Load.	Three-fourths Load.	Full Load.	
91.0	93.0	94.0	Guaranteed
92.0	94.1	95.3	Tested

The direct-current machines are shunt-wound units designed to operate in parallel with the storage battery. They have commutating poles and also auxiliary shunt-field windings which are separately excited from the storage-battery booster and play an important part in the scheme for regulating the load. The auxiliary winding is of such strength that when the generator is operating under normal load at 650 volts the voltage can be raised to 700 or reduced to 575, so that it can be used for either charging or discharging the battery. These motor-generator sets are seen in the general view of the interior of the station, Fig. 1.

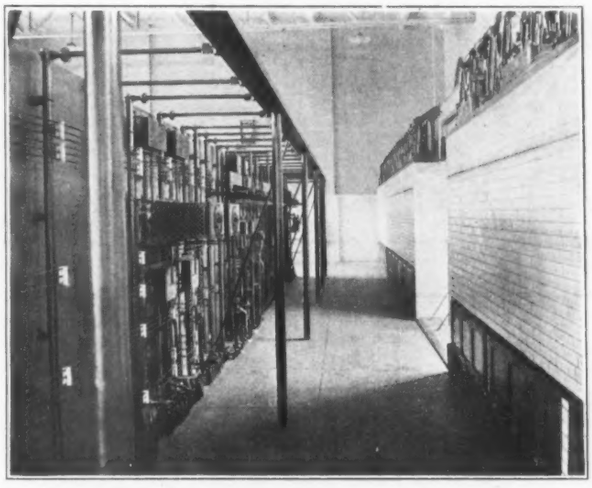


Fig. 2—Rear of Main Switchboard.

Fig. 1—Interior of Converter Station.

The 50-kw motor-generator set consists of a 75-hp, 650-volt shunt-wound direct-current motor directly connected to a 50-

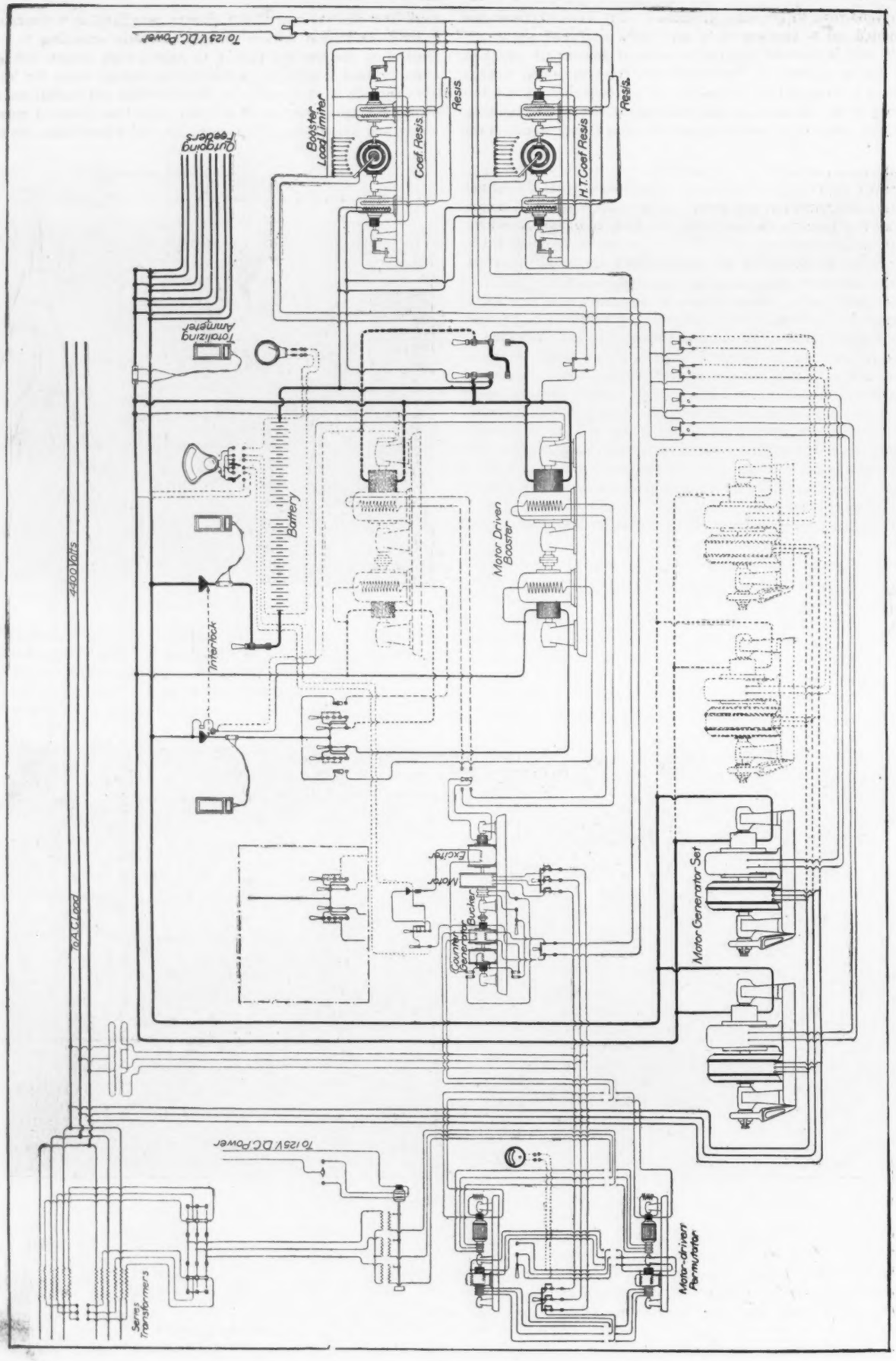


Fig. 3—General Arrangement of Circuits Connected to the Storage Battery.

kw, 4400-volt, three-phase generator. The two machines are mounted on a common base and form a three-bearing set. This unit is installed to provide a small amount of 4400-volt alternating current by driving the set from the main storage battery in case of total shut-down of the Detroit Edison Company's lines. In this manner one-half of the tunnel lighting, a small amount of pumping, signal lamps and signal track

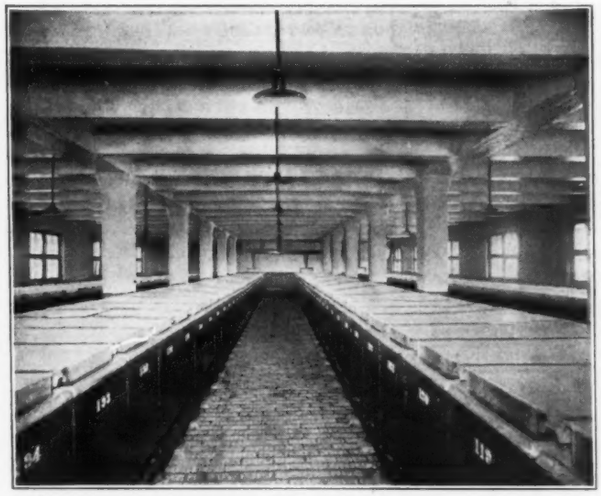


Fig. 4—Battery Room.

transformers can be operated, while the railway load would be carried on the main battery.

The battery consists of 312 Gould cells in fifty-nine plate tanks. Each plate element is 18.5 in. square and has a discharge rating varying from 630 × 8 amp-hours to 2520 × 1 amp-hours, and is capable of withstanding momentary discharges as high as 800 amp.

In connection with the battery use is made of a motor-driven booster, an exciter set for the booster and a small rectifier set for obtaining current for regulating purposes, which varies according to the ampere times the power-factor on the incoming supply. One floor of the battery house is shown in Fig. 4, while the exciter set, the motor-driven booster and the small regulating rectifier set are illustrated respectively in Figs. 5, 6 and 7. The load requirements are such that, taken in connection with the relatively low average demand, a practically instantaneous response to load changes must be obtained from the battery and booster, and to accomplish this result a special Gould high-voltage exciter has been pro-

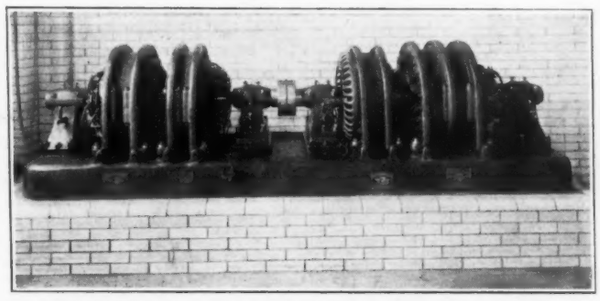


Fig. 5—Counter E.m.f. Generator, Bucker, Motor and Exciter.

vided, which upon the change of load occurring impresses an abnormal voltage on the booster field circuit. This voltage is maintained until the proper current flows through the booster field circuit to cause the booster to respond and so compel the battery to charge or discharge in accordance with the load changes.

To reduce the size of the battery required to accomplish the work and also the size of the booster necessary, it is desirable to have the station voltage changed inversely according to the demand on the station; that is, to have a high station voltage when the load is light and a low station voltage when the load is heavy. It is, however, not desirable that the variations in station voltage should occur at times other than times of maximums and minimums. To accomplish this a load-limit device,

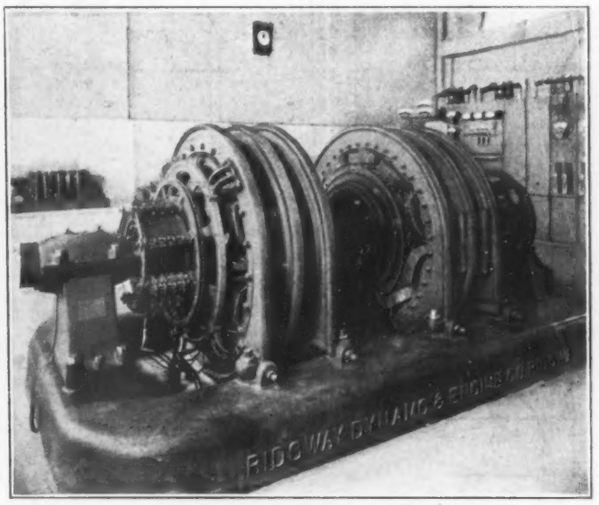


Fig. 6—Booster Set.

shown in Fig. 8, has been installed, which changes the excitation of the direct-current end of the motor-generator sets either when the booster voltage output rating is reached or when the booster current rating is reached, but at all other times permits normal excitation of the motor-generator set. This causes the motor-generator set voltage to be increased when the booster voltage reaches the limit in a charge direction or when the booster current reaches the limit in a charge direction, and decreases the voltage of the motor-generator set when either the booster voltage or current rating in a discharge direction is exceeded.

Inasmuch as the energy is purchased on a kw-hour basis, it is desirable that when the voltage is decreased on the motor-generator sets the current be increased, and to accomplish this a booster load-limit device has been installed. In the event of a load carrying beyond the capacity of the battery and booster this apparatus automatically shifts the excess load from

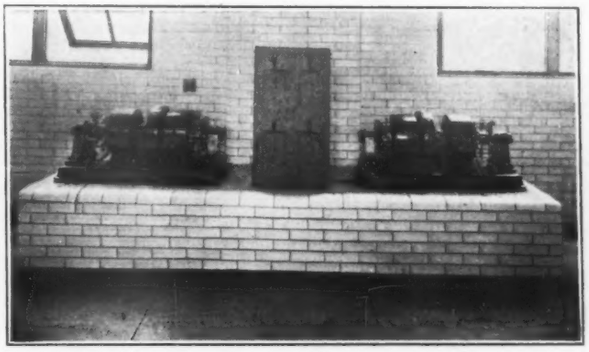


Fig. 7—Rectifier and Permutator Set.

it to the motor-generator set, thus preventing the opening of the battery circuit-breaker and the consequent transference of the total load to the motor-generator set, which would result in the opening of the motor-generator circuit-breakers. This load-limit device is actuated by the battery discharge current and the battery charge current and by the booster voltage in a charge direction and in a discharge direction. When the bat-

tery is discharging and this load-limit device is actuated additional load is thrown on the motor-generator sets, and when the battery is charging and the load-limit device is actuated the load is removed from the motor-generator sets, but this device, like the load-limit control of the motor-generator sets, does not come into operation until certain limits have been reached. At all other times the regulating apparatus and the

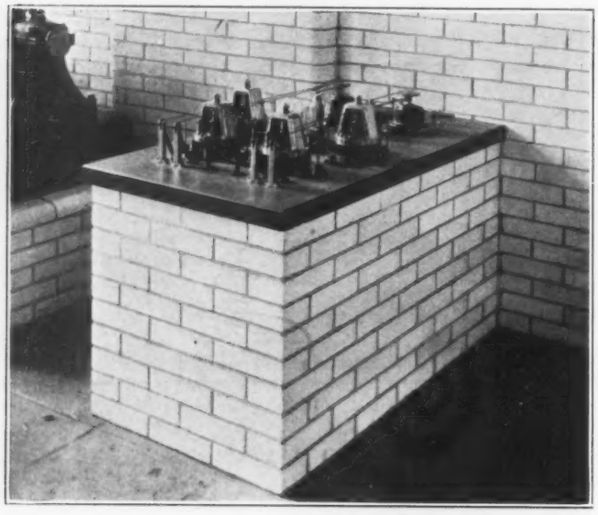


Fig. 8—Quadruple Load-Limit Device.

battery preserve practically constant load on the lines of the Detroit Edison Company.

It is thought that the following details of the apparatus may be of interest: In the incoming lines from the Detroit Edison Company series transformers are inserted and from these series transformers current is led to a small rectifier set which consists of a synchronous motor and a small permutator. The synchronous motor drives the permutator in synchronism with the voltage, but in a reverse direction to the direction of the field set up by the current from the series transformers. This results in a field which is fixed in space so long as the power-factor is unchanged. The permutator is provided with two sets of brushes, one practically at 90 electrical space degrees to the other, one set being connected to the field circuit of the counter machine and the other set connected to a by-pass circuit. The brushes are so set that with the normal current flowing from one set of brushes through the field circuit of the counter machine no current flows through the by-pass circuit when the power on the incoming lines from the Detroit Edison Company is at 100 per cent power-factor. When set in this way a change in power-factor on the incoming lines without a shift of current will cause the current supply from the permutator to the field circuit of the counter machine to be reduced and the current to flow in the by-pass circuit, and by proper adjustment of the resistance of the two paths the current flowing through the counter machine field circuit is at all times proportional to the current times the power-factor on the incoming lines from the Detroit Edison Company.

From the counter machine armature a circuit extends to and includes one field circuit of the exciter and the armature of the bucker, this bucker being a machine designed to generate constant voltage irrespective of the direction and amount of current through its armature and provided to furnish a constant opposing force for the regulation to work against. The voltage of this bucker is equal to the voltage of the counter machine when the normal load is on the incoming lines, and any change in load on the incoming lines will cause current to flow from the counter machine or to the counter machine through the exciter field circuit, depending on whether the load is increased or decreased. From the exciter armature a circuit extends to the booster field circuit and includes a reverse series winding on the exciter. This winding cuts down the exciter voltage when current flows to the booster field circuit, thus permitting an abnormal voltage to be obtained from the exciter and applied to the booster field circuit as long as required, or until current begins to flow through the booster field circuit, when this voltage is cut down in proportion to the current flow to the booster field circuit. The wiring details of this apparatus are shown in Fig. 3.

In this plant the time required to reverse the booster from 80 volts in one direction to 80 volts in the other direction, with normal voltage applied to its terminals, is approximately four and one-half seconds. By using the differential exciter an e.m.f. as high as 300 volts can be impressed on the booster field circuit, which is wound for approximately 20 volts. The result is that the response of the booster is enormously quickened, and this excess voltage is cut down exactly as desired, so that at no time does an excessive or abnormal current flow through the booster field circuit. Means are provided whereby the average load supplied by the Detroit Edison Company can be changed at will to accommodate this system to different schedule conditions. Means are also provided whereby the regulation can be changed from 7½ per cent to 33⅓ per cent; that is to say, the incoming power from the Detroit Edison Company can be kept constant within the limits of plus or minus 7½ per cent or can be permitted to vary plus or minus 33⅓ per cent from any desired average.

UNUSUAL CURRENT RELATIONS IN CONDENSIVE AND INDUCTIVE CIRCUITS.

By Alfred Still.

ALTHOUGH the somewhat unexpected effects from the presence of both inductance and capacity in an alternating-current circuit are discussed in textbooks and may be assumed to be generally understood, the writer believes that the explanation of some results obtained under actual working conditions may be of sufficient interest to warrant publication of this article.

The diagram in Fig. 1 shows the arrangement of some apparatus used for the purpose of making high-voltage insulation tests on electric cables. This apparatus consists of an alternator *G* supplying energy to a variable-ratio transformer which in turn provides energy for the primary of a step-up transformer. The coils of a cable to be tested for insulation are connected in parallel across the secondary terminals of the step-up transformer; the actual arrangement consists of a water tank in

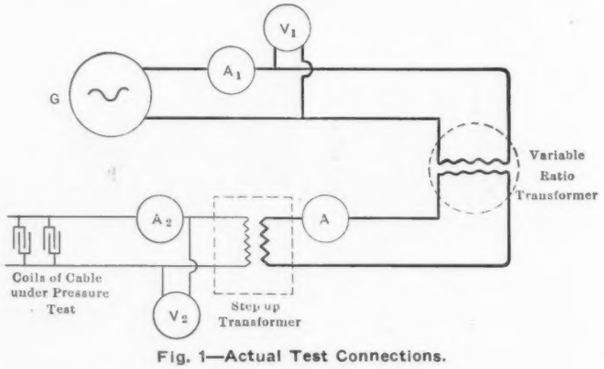


Fig. 1—Actual Test Connections.

which the coils under test are immersed, the free ends being connected to one terminal of the step-up transformer through a common insulated conductor, while the tank itself is connected to the other terminal of the transformer. It follows that the current indicated by the ammeter A_2 is largely a capacity current, the value of which will be proportional to the number of (similar) coils connected in parallel under test.

In regard to phase, this current will be in advance of the impressed voltage by nearly a quarter of a cycle and the current will be practically "wattless." If the magnetizing currents of the transformers were so small as to be practically negligible then the three ammeters A_3, A and A_1 would all give indications proportional to the total electrostatic capacity of the cables under test. Observations taken while varying the

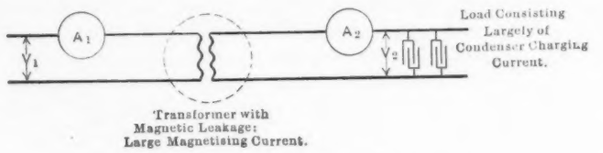


Fig. 2—Equivalent Test Connections.

number of similar coils of cable connected up to the testing transformer, and noting the readings of the three ammeters, showed that, although the readings on ammeters A and A_3 were substantially proportional to the load—that is, to the number of coils under test—the ammeter A_1 in the primary circuit of the variable ratio transformer showed a *decrease* in the current as the number of coils was increased from 1 to 5, after which it showed an increase with the addition of further coils.

When carrying out these tests the frequency of the supply current and the test pressure were kept as nearly constant as possible, but owing to slight variations not only in these quantities, but also in the transformation ratio of the variable ratio transformer, the readings actually obtained are not given; they are not essential and would be of little value unless accompanied by somewhat lengthy explanations.

The peculiar changes of current as indicated by ammeter A_1 (Fig. 1) are due to the fact that the variable-ratio transformer, being constructed with an air-gap between the fixed and movable portions of the iron cores, has necessarily a large "wattless" magnetizing current.

In the case of the step-up transformer—which had a closed iron circuit—the magnetizing current was very small; and this accounts for the readings of both ammeters A and A_3 being approximately proportional to the number of coils of cable under test.

For the purpose of drawing a simple diagram of current vectors the step-up transformer may be omitted and the arrangement of the testing plant would then be as indicated in Fig. 2. The condition is that of an imperfect transformer,

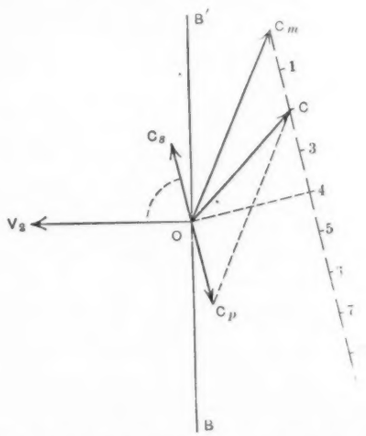


Fig. 3—Vector Diagram of Three-Phase Relation.

having a large wattless magnetizing current, connected on the secondary side to a circuit of very great electrostatic capacity as compared with its resistance and inductance.

In the vector diagram of Fig. 3 let the vertical line BB' represent by its direction the time phase of the magnetic flux passing through the secondary windings of the variable-ratio transformer. The induced volts in the secondary will be OV_2, lagging exactly ninety time degrees behind the magnetism. The magnetizing current in the primary circuit—if entirely "wattless"—would be in time phase with the magnetic flux; but owing to the presence of iron in the magnetic circuit the phase of the actual primary current, even with no load on the secondary, will be somewhat in advance of the magnetism, as indicated by the vector OC_m, which represents the total primary current when the secondary circuit is open, or that component of the total primary current which must always be present so long as the voltage V_2 is maintained at the secondary terminals.

On account of the nature of the load the time phase of the current taken from the secondary windings of the transformer will be very nearly one-quarter period in advance of the secondary e.m.f., and the vector OC_s, drawn very nearly ninety time degrees in advance of the vector OV_2, may represent such a current.

Consider now what takes place in the primary circuit. It is clear that the secondary current must be balanced by an exactly equal but opposite component of the total primary current[1] in

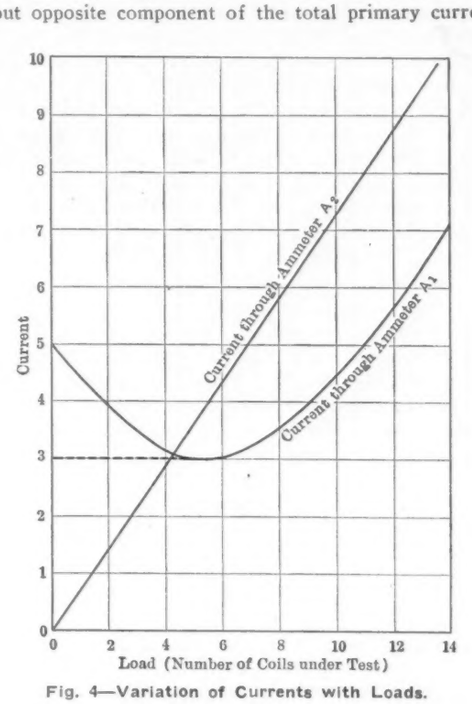


Fig. 4—Variation of Currents with Loads.

order that the *resultant* amp-turns required to maintain the magnetic flux shall remain as before. Therefore, OC_p may be drawn exactly equal in length but opposite in direction to OC_s, to represent this balancing component of the primary current, and by compounding OC_p and OC_m in the usual way, OC is obtained for the total current in the primary circuit when the current OC_s is taken from the secondary terminals. It will be observed that OC is *smaller* than OC_m for this particular value of the secondary current, and this reduction in the primary current when a small secondary current is taken from the transformer is clearly due to the peculiar time-phase relation between the leading secondary current (on the capacity load) and the lagging primary magnetizing current (due to the air-gap in the iron core of the transformer). The numerical values chosen for the construction of the diagram (Fig. 3) are 5 for the magnetizing current and 2 for the "load" current. It will be seen that as the secondary current is increased (by connecting up more coils of cable in the testing tank) the primary current will continue to fall until $C_s = 4$, which brings the resultant OC in time-quadrature to OC_s; but with a further increase of the secondary current the primary current will also rise.

In Fig. 4 the numerical values of the secondary current and the total primary current have been plotted for increas-

[1]For the purpose of simplifying the diagram a transformation ratio of 1:1 has been assumed.

ing values of the secondary load, from open secondary circuit up to a total load of fourteen coils of cable; and the manner in which the primary current falls from 5 amp on open circuit to a minimum of 3 amp with five coils under test, after which it grows at an increasingly rapid rate, is very clearly indicated on the diagram. It may be mentioned that, although the actual readings taken under working conditions are not plotted, the average of the observed results very closely follows the theoretical curve which has been drawn.

CURRENT-RATIO AND PHASE-ANGLE TEST OF SERIES TRANSFORMERS.

By H. S. Baker.

THE method here described for determining the current-ratio and phase angle of series transformers consists in bucking a known multiple of the primary amperes against another known multiple of the secondary amperes and reading the vector difference upon a wattmeter. The only apparatus required consists of a wattmeter of the moving-coil type, an ammeter, a laminated iron ring upon which may be wound various numbers of turns of wire, and a lamp bank. There must also be available a source of polyphase e.m.f., a source of heavy current and switches, as shown in Fig. 1.

The procedure of test is as follows: The apparatus is connected as shown in Fig. 1. The test ring shown has one primary turn, with secondary turns, shown in full line wound approximately uniformly around the ring. The tertiary winding, shown in dotted line, is also wound approximately uniformly around ring. This tertiary winding feeds through the switch *B* directly into the moving coil of the wattmeter.

Voltage taps are taken off at the secondary terminals of the transformer under test and connected through the switch *C* to the moving coil of the wattmeter through the regular meter resistance shown. The series coil of the wattmeter is supplied with 5 amp, which may be taken from either of two e.m.f.

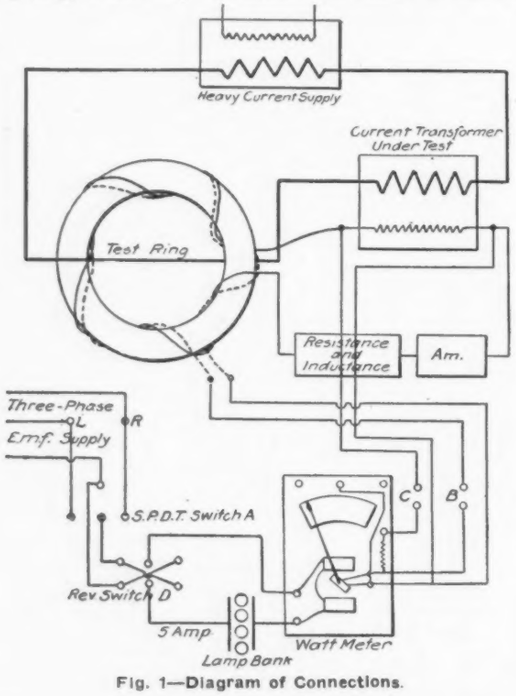


Fig. 1—Diagram of Connections.

phases through the switch *A*, and may be reversed at will by means of the switch *D*.

Current is supplied through the heavy current circuits as shown. Care should be taken that the primary and secondary amperes are bucking in the test ring and not adding. The switches *A* and *B* are closed to the right and the switch *D* closed in the direction giving a plus deflection on the wattmeter. If *D* is to the right the reading may be designated plus and if to the left minus. The switch *A* is then closed to the left and another reading taken.

The above two readings represent components of tertiary amperes along directions of the two e.m.fs. used. The series secondary terminal voltage may now be read as follows:

Close the switches *A* and *C* to the right and the switch *D*

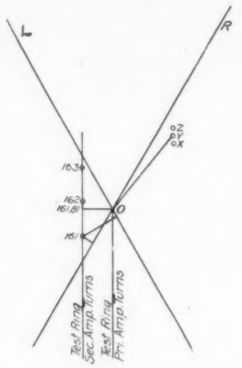


Fig. 2—Diagram for Interpolating Test Results.

in the direction to give a plus deflection of the wattmeter. Read the wattmeter and then throw switch *A* to the left and repeat the reading. These two readings represent components of secondary terminal volts along the same two directions.

The above four readings were as follows in the case of a series transformer marked 400 to 5 amp, a test ring with two primary turns being used:

Ring Secondary Turns.	Secondary Amperes.	TERTIARY CURRENT.		SECONDARY VOLTS.	
		R.	L.	R.	L.
161	3.6	—89	—22	+4.0	+1.3
162	3.6	—22	+46	+4.4	+1.6
163	3.6	+47	+118	+4.9	+2.0

Fig. 2 is a diagram in which the above readings are plotted for 161, 162 and 163 turns. The lines *OR* and *OL* are 60 deg. apart, representing two sides of the three-phase e.m.f. supply shown in Fig. 1. *OL* was assigned the e.m.f. phase which leads *OR* in order to give the diagram correct rotation. The point 161 was determined by measuring along *OR* a distance (see table) of minus 89 and erecting a perpendicular to *OR*, then measuring along *OL* a distance of minus 22 and erecting a perpendicular to *OL*.

The intersection of these perpendiculars gives the point 161, and the vector *O* — 161 is the only line having projections along *OR* and *OL* of the values of minus 89 and minus 22. This vector thus represents the current flowing in the tertiary winding when 3.6 amp are in the secondary of the transformer under test, and when 161 to 2 is the ratio of the turns on the test ring. Similarly, the points 162 and 163 are plotted from the corresponding readings.

It will be seen that adding one turn to the secondary of the test ring changes its secondary amp-turns in magnitude but not in phase, and in going from 161 to 162 the point has passed *O*. At the interpolated point 161.81 the vector *O* — 161.81 is at right angles to the secondary amp-turns of the test ring. This is the vector difference between the primary and secondary amp-turns of the test ring. At this point the test ring secondary and primary amp-turns are of closely equal magnitude because their vector difference is approximately perpendicular to both. We know then that the vector ratio of currents is 2 to 161.81, or the current ratio is in error by 1.81 ÷ 160, or 1.13 per cent.

The phase difference between the primary and secondary amperes is determined by measuring the distance *O* — 161.81

and dividing it by 161.81 times the distance 161 — 162, which operation gives the tangent of the angle of secondary current lead.

The voltage delivered by the transformer under test is determined by plotting the voltage points x, y and z from the above voltage readings and interpolating between x and y in the same ratio as the point 161.81 is between the points 161 and 162. The voltage at this interpolated point will be found to be 4.4 volts. The secondary amperes were taken as 3.6. The following data are then obtained for this point:

Secondary Amperes.	Secondary Volts.	Ratio.	Phase Lead.
3.60	4.4	$\frac{161.81}{2}$	$\frac{0.89}{161.81}$

Other points taken on this same test were as follows:

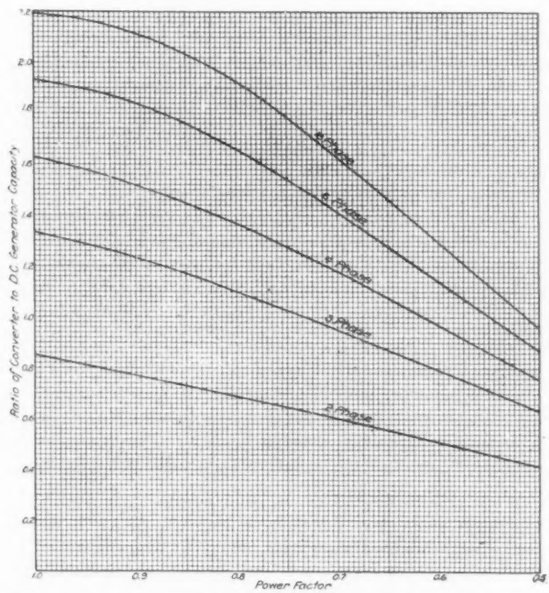
1.64	$\frac{162.22}{2}$	$\frac{1.33}{162.22}$
1.45	$\frac{162.53}{2}$	$\frac{1.57}{162.53}$

The above test of three points on the ratio curve was carried out and plotted by convenient means in forty minutes and forms a method at once available and effective.

COMPARATIVE CAPACITIES OF ROTARY CONVERTERS.

By W. L. Durand.

Anyone accustomed to electrical machinery must have noticed the decided difference in size between an alternating-current or direct-current generator and a rotary converter of the same capacity. The reason for this is not apparent unless a study be made of the different manner in which the two



Variation of Output Rating of Converters of Different Number of Phases (Collector Rings), with Change in Power-Factor.

machines reach their limit of capacity as a result of the heating effect.

In a rotary converter the commutated continuous and alternating currents are, taken as a whole, in phase opposition to one another. At any load, therefore, it is to be expected that the effective resultant current should be less than the corresponding alternating-current or direct-current values. This is true of all but the single-phase rotary. It thus follows that the capacities of all but the single-phase rotary must be greater than their corresponding generator capacities.

In the *Sibley Journal of Engineering* for June, 1897, Dr. Charles P. Steinmetz gives an analytical treatment of the heating effect in a rotary converter when the power-factor equals unity, resulting in the derivation of the following equation:

$$\rho = \frac{8}{n^2 \sin^2 \frac{\pi}{n}} + 1 - \frac{16}{\pi^2}$$

where ρ is the ratio of the aggregate heating effects of a converter lead to the same direct-current load and n is the number of phases, or rather the number of collector rings.

As the heating effects are inversely proportional to the squares of corresponding capacities, capacity is, therefore, inversely proportional to the square roots of the heating effects, thus:

$$\frac{\text{converter capacity}}{\text{direct-current generator capacity}} = \frac{1}{\sqrt{\rho}}$$

Substituting numerical values for n in the above equation we obtain the following table:

n	2	3	4	6	12
ρ	1.3788	0.5641	0.3789	0.2677	0.2079
Capacity	0.8518	1.331	1.625	1.932	2.193

From this table it is clear that a decided economy results from the use of a rotary with a large number of phases, as the capacity is much greater than that of a machine with a smaller number of phases. The most common type of transmission line is three-phase, but in nearly every case where a rotary is used it will be found to be a six-phase machine. The reason for this becomes evident when it is seen that a six-phase rotary has a capacity nearly 50 per cent greater than that of a three-phase machine.

The ratio of the current heating effects produced in the armature winding of a rotary will be proportional to the squares of the respective currents; that is $\left(\frac{i}{\frac{I}{2}}\right)^2$ where i is the alternating current and I the direct current.

Prof. H. J. Ryan has shown that it is possible to derive an equation that shall also take account of varying power-factor. In brief, this is accomplished by integrating and averaging $\left(\frac{i}{\frac{I}{2}}\right)^2 d\omega$ between the limits of $\pm\frac{\pi}{n} + \cos^{-1} P$, where ω is the displacement of armature section from the section wherein the working alternating current and the continuous current are in phase opposition, as follows:

$$\rho = \frac{8}{P^2 n^2 \sin^2 \frac{\pi}{n}} + 1$$

$$- \frac{8}{\pi^2 \sin \frac{\pi}{n}} \left\{ \frac{\sqrt{1-P^2}}{P} \left[\cos\left(\cos^{-1} P - \frac{\pi}{n}\right) \right.\right.$$

$$\left. - \cos\left(\cos^{-1} P + \frac{\pi}{n}\right)\right] + \sin\left(\cos^{-1} P + \frac{\pi}{n}\right)$$

$$\left. - \sin\left(\cos^{-1} P - \frac{\pi}{n}\right)\right\}$$

As this equation is rather long and complicated, much time will be saved by using the accompanying curves, which have been plotted for values of n from two to twelve, and for values of P from 1.00 to 0.50. If the curves be examined it will be seen that a slight decrease in the power-factor from unity will not make any great difference in the capacity, but if the power-factor drops off in any marked degree there is a decided falling off, especially in the higher phase rotaries. As most rotaries in use are of the six-phase type, it is clearly evi-

dent that it is of great importance to keep the power-factor as near unity as possible when the machine is running near its rated capacity.

HYDROELECTRIC DEVELOPMENT IN WURTTEMBERG, GERMANY.

A series of works on a large scale has been proposed for the utilization of the water-power of the rivers Würm, Enz and Nagold in the Kingdom of Württemberg. It is intended to build central stations to deliver electric current for power and light to towns and villages within a radius of thirty miles and more. The project originates with Messrs. E. Schleicher, of Stuttgart, and L. Kürsteiner, of St. Gallen, two engineers who have constructed important waterworks in Austria and Switzerland. The program for the construction of the concentrated waterworks is (1) preparation of a great collecting basin in the Valley of the Würm, between the towns of Würm and Mühlhausen; (2) utilization of the fall between the Stausee and the junction of the Würm with the Nagold, a maximum of 103 m (337.8 ft.), for a high-pressure plant with a large steam plant as reserve. Both plants can be used in a power station at the so-called Kupferhammer, where the Würm empties into the Nagold, in the Pforzheim "Gemarkung" or district. The Valley of the Würm, from the Village of Würm upstream as far as Mühlhausen, is almost uninhabited and but little cultivated, but is very well suited as the site of a dam. The upper dam wall for the reservoir is 322 m (1086 ft.) long on top and 22 m (72.2 ft.) at the bottom. The embankment will contain 225,000 cu. m (7,945,875 cu. ft.). The rain basin of the Würm which contributes to the dam has an area of about 400 sq. km (154.4 sq. miles). The dam will impound about 36,000,000 cu. m to 37,000,000 cu. m (1,268,640,000 cu. ft. to 1,306,655,000 cu. ft) and is sufficient to permit storing up the entire annual rainfall. The daily capacity of the Würm power station is, on work days, 96,000 hp-hours, the yearly capacity being 31,000,000 hp-hours. Experience shows that the daily demand of the combined power and light plants, including electric railway service, is at most seven to eight hours. It is intended, in consideration of the fact that the Würm power station has to take care of the maximum demands of the Enz-Nagold plants, to fix the maximum capacity at 20,000 hp. For this there will be necessary five groups of machines of 4000 hp each, one serving as a reserve.

The water of the Enz will be stored up by a solid dam and that of the Nagold by a "safety" dam. The water of the Enz will be carried by a race in a southeasterly direction under the heights of Büchenbronn and over the Nagold through a pipe at a height above all danger from floods, for the purpose of uniting it with that of the Nagold, which will be reached at about the boundary between Baden and Württemberg. The waters of the Enz and the Nagold will be carried in common by a race in three sections of each 3000 m (11,808 ft.) in length to the Wasserschloss and the high-pressure pipe line at Kupferhammer. The effective power of the low-pressure plant will be 4500 hp, but with very low water may drop to only 1500 hp. In order to eke out the power when the water is low there will be a reserve steam plant having two steam turbo-generators each of 1500 hp, which will be installed directly alongside of the power station of the hydraulic plant. The total maximum daily capacity of the two plants (Würm and Enz-Nagold) will be 24,500 hp. The combined cost of carrying out the two projects will be about 18,000,000 kronen ($3,600,000). It is stated that offers have already been made for concessions to take over the project.

Central Station
Management, Policies and Commercial Methods

DEPRECIATION.

Two papers on "Depreciation" were presented last year at the annual meeting of the Mississippi Electric Association, the *Proceedings* of which have just appeared in printed form, and from which the accompanying table is compiled. The first column appears in the paper by Mr. S. W. Greenland, and the second column in the paper by Mr. Jack Abbott. The columns give the estimated number of years of life.

Buildings	50	50
Boilers	12–20	—
Engines	20	15–20
Generators	12–25	15
Condensers	15	10–15
Pumps	15–20	12–15
Piping	21	—
Switchboards	20	—
Transformers	10	15–20
Meters	20	15
Poles	12	10–15
Cross arms	—	5–10

HOUSE-WIRING CAMPAIGN.

Mr. C. B. Yonts, manager of the sales department of the Illinois Traction Company, writes in reference to the house-wiring campaigns conducted in the interest of the Byllesby properties and noted in our issue of Jan. 5 that a similar campaign was conducted in 1909 by the Illinois Traction System in connection with the central stations operated by it, and that the greatest objection found to the plan was that the business taken in three months was so much greater than expected that it necessitated the doubling of the force in the construction and meter departments, and when the rush work was over the extra men had to be laid off. In 1910 it was decided to try the plan for the entire year, and this was found more successful than the old way, inasmuch as orders could be taken and connected the same week, which is of great importance to the salesman in securing the signature of his next prospect; and there was steady work instead of a congestion for two or three months. A smaller force of men operating in five cities with a total population of 100,000 wired 869 old houses in nine months; 500 electric irons and thirty-one electric signs were sold, sixty-five show windows rewired, the interior illumination was changed in a number of business houses, while the missionary work done cannot be estimated. In this way the efficiency of the sales department was also brought up, as it was found that the men give their undivided attention to the work when they know that it is permanent.

GROUNDING THE SECONDARY.

At the annual meeting of the Mississippi Electric Association last year, the report of which has just appeared in printed form, Mr. R. P. Strong, of New Orleans, presented a paper entitled "Grounding of Electrical Secondaries," which gives a very complete discussion of the subject. A number of specific cases are mentioned in which death and fires resulted from unprotected secondaries. An interesting comparison of grounded and ungrounded secondaries was furnished by a severe storm on Sept. 20, 1909. This resulted in a number of fires and the loss of several lives from electrical causes in New Orleans, while in the neighboring town of Houma, where the secondaries are grounded at the transformers, there was not a single trouble of this nature during the same storm, although the primaries became crossed with secondaries in so many places that the plant was forced finally to shut down. The paper reprints a letter from the Mobile Electric Company, which says that a very

distinct advantage has been gained by grounding the secondaries, as before this was done there had been a number of serious accidents; furthermore, no increase in operating troubles has been found to accompany the grounding. Mr. Strong strongly recommended the grounding of all alternating-current systems, preferably to sub-surface piping systems. He recommended that where a secondary system is grounded the interior-wiring system connected thereto should previously be carefully tested and cleared of any grounds, as otherwise the grounding of an outside line might complete a short-circuit and cause a more or less serious burn-out on the inside wiring. He believes it is the duty of every central station to ground all secondaries as a protection to life and property. The item of expense, he said, can have no bearing except in favor of grounding, as the courts have repeatedly decided that lighting companies are liable for damage caused by abnormal pressures on low-tension systems. When one considers, he adds, the many thousands of people who daily come in contact with current-carrying parts of the secondary circuit while they are standing upon grounded surfaces or in contact with grounded objects, and are protected from sudden death only by a few layers of cotton insulation, the question is not so much why the secondaries are not grounded, but how central-station men, knowing their responsibility, are able to proceed in peace in the pursuit of happiness.

MINIMUM RATE IN INDIANA.

The city authorities of Muncie, Ind., have begun an investigation of the franchises of public-service corporations doing business in that city to learn which, if any, has a right to impose a "minimum charge" on customers. The investigation follows an announcement by the Muncie Gas Company that a "minimum charge" of 50 cents on each connection would be levied in the future, regardless of the amount of gas consumed.

LAUNDRY SHIRT CARDS AS ADVERTISING MEDIUMS.

The stiffening cardboards inserted in shirts returned from the laundry are made effective advertising mediums by the Indiana & Michigan Electric Company, South Bend, Ind. The central-station company supplies these cardboards, measuring 8 in. x 15 in., to the laundry free of cost. The cards are of good quality board and each week differ in color and in the running inscriptions advertising the use of electricity and electrical appliances. The laundry using the cards serves the best class of people in the city, so that the electric company is assured of its advertisements reaching the homes which, if not already customers, are likely to become users of electricity. Electric toasters, stoves, irons, etc., are also advertised on the laundry cards now and then, with the idea of reminding present consumers of the convenience of these appliances.

LABOR-SAVING DEVICES AND THE SERVANT PROBLEM.

The committee on household economics of the New Jersey Federation of Women's Clubs in order to prove that the installation of modern labor-saving devices in the home will solve the servant problem is at present equipping a home in Colonia, N. J., with apparatus for eliminating to a great extent the drudgery of housework. Speaking of the proposed scheme, Mrs. F. A. Pattison, president of the federation, is quoted, in part, as follows: "Realizing that we could talk, discuss and write papers on the subject until doomsday without any real results, we determined to demonstrate visibly the practical value of the proposition. One result, important, if not the chief, will be the solution of the servant-girl problem by eliminating from the servant class the present undesirables and those woefully ignorant of their duties. It will introduce the specialized servant. The installation of these mechanical devices will also reduce the number of servants in the large establishments of the wealthier class, and for those whose ménage is more modest and where one maid is sufficient the work of three can be obtained, precious time be saved and cleanliness be supreme." Mrs. Pattison is convinced that electricity will prove in the future the salvation of the housekeeper. The organization proposes to make housework the fashion, and when its little home is running will arrange for pilgrimages from all over New Jersey, from New York and from Pennsylvania.

USEFUL WORK IN SHOP PRACTICE.

In a pamphlet issued by the Cosmopolitan Electric Company, of Chicago, to further the sale of electricity for electric drive the argument of the economy which often may be obtained by the use of electric motors in manufacturing establishments is put in a forceful way, as may be seen by the following extracts:

"The celebrated remark of Mr. Roosevelt, i.e., 'the shots that hit are the shots that count,' applies with at least as much force to shop practice as to gun practice, for the power applied at the point of contact between the tool and the work alone earns money. All else is waste at your expense.

"The expression 'the tool and the work' must not be construed as having reference solely to machine-shop equipment. It is here used in the broadest possible sense to indicate the relation, for instance, between the lumber and the saw, the grain and the millstone, the rock and the crusher, the load and the elevator platform, the train and the locomotive drawbar. Any intermediate devices, either for the generation of power or its transmission to the point of contact between 'the tool and the work,' are wasteful; and as it is from actual work accomplished that you make your profits, it must be apparent that the measure of your commercial success is directly affected by the degree to which you eliminate waste.

"Assuming the monthly cost of your home-generated power to be any amount that your knowledge of conditions in your boiler, engine and transmission equipment may indicate to be approximately correct, did it ever occur to you that a great deal more than half of this sum is wasted?

"If you doubt it, the proof is easy to obtain for yourself. Run your entire plant for a full day on Sunday, all individual machine belts on loose pulleys or with clutches out, and weigh the coal. Figure cost of fuel, multiply by twenty-five (number of working days per month) and compare result with your normal monthly cost of coal. The difference between the two amounts is the value of power actually used in useful work. Compare this difference with your present total monthly cost, and the result will set you thinking."

FLAT-RATE WINDOW LIGHTING IN MASSACHUSETTS.

In a number of Massachusetts cities the local lighting companies have added to their incomes by means of window-lighting propositions with tungsten lamps covering the hours from sunset to midnight. In a majority of cases time switches are employed, and all are placed on a flat-rate basis. In Lowell the Lowell Electric Light Corporation charges $1.50 per 100-watt tungsten lamp per month, net. The company also rents tungsten lamps with shades and holders at the rate of 18 cents net per lamp per month, which plan appeals to small mer-

chants who would otherwise find the first cost of the outfits burdensome. The lighting company cleans the fixtures at regular intervals. Fig. 1 shows a typical flat-rate window in Lowell.

At Haverhill, Mass., the Haverhill Electric Company has over seventy-five customers using in the neighborhood of 1150 lamps on its flat-rate sign and window-lighting plan. The

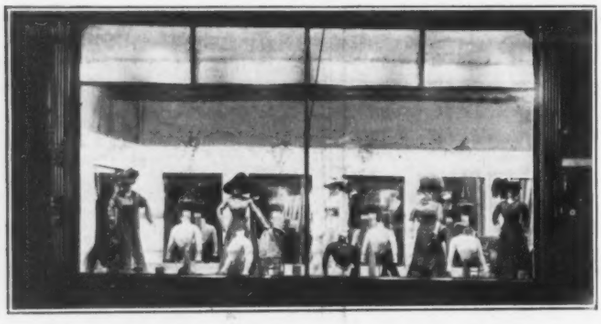


Fig. 1—Flat-Rate Window Lighting at Lowell, Mass.

flat rate for tungsten lamps for window lighting is 50 cents, 65 cents, 95 cents, $1.50 and $3.65 per 20-cp, 32-cp, 48-cp, 80-cp and 200-cp lamp respectively per month. This service includes free renewals of all lamps that are burned out or blackened so as to lower the candle-power materially. Time switches are

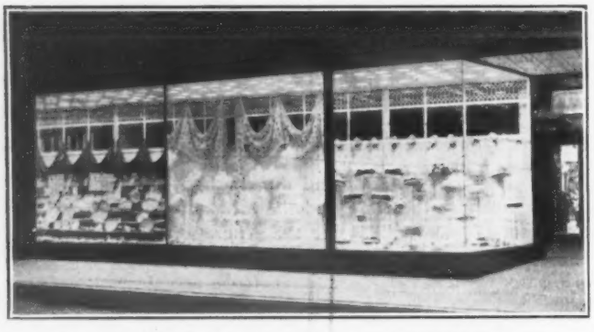


Fig. 2—Flat-Rate Window Lighting at Haverhill, Mass.

sold at cost or rented for $1.25 per month. A window lighted with 40-watt tungstens on a flat rate in Haverhill is shown in Fig. 2.

The Fitchburg Gas & Electric Light Company has a connected load of over 30 kw in flat-rate window lighting. The prices for this service are the same as given for Haverhill.

Fig. 3—Flat-Rate Window Lighting at Fitchburg, Mass.

The window illumination of a typical shoe store (Fig. 3) on a flat-rate basis costs the merchant $62.40 per annum, including lamp renewals and switching service incident to the proposition. In the case of a typical haberdashery the yearly cost amounts to $78 per annum. The first installation is lighted by eight 40-watt tungstens at each window and the second by ten 40-watt lamps.

ELECTRIC LIGHTING RATES IN GERMANY.

The following information relating to German central-station rates is given in a recent consular report by Mr. William T. Fee, United States consul at Bremen, which contains data for twelve of the largest cities in Germany:

In the majority of cities there is a meter rent averaging from 25 cents to 50 cents a month. In few cities is the flat rate in vogue, Bremen being about the only city of any importance where it is used. In most other cases there is "special time," generally from about 4 to 8 o'clock in the evening, depending on the season of the year, when the rate is much higher than at other hours. It is the time of the maximum demand and is charged for accordingly. Bremen now charges the highest price for electric current of all cities in Germany, but a reduction is promised after the electric plant is operated by water-power from a dam in the River Weser now under construction.

Rates are not in proportion to the maximum number of lights that can or may be used in an installation. Lights for elevators in buildings are given at power rates, which run from 2 cents to 5 cents per kw-hour. When an installation is made a fee is charged by the lighting company for inspecting the installation, lamps, etc. The charges are based upon the number of units and average about 3 cents to 6 cents a lamp.

Below are given in detail the hours when consumers in one of the twelve cities must pay 12 cents per kw-hour for current. At other hours it costs only 4 cents. This rate is fairly indicative of the charges in other cities of Germany.

Month.	Hours.	Month.	Hours.
January	4.30 to 9 p. m.	August	7.30 to 9 p. m.
February	5.30 to 9 p. m.	September	6.30 to 9 p. m.
March	6.30 to 9 p. m.	October	5.30 to 9 p. m.
April	7.30 to 9 p. m.	November	4.30 to 9 p. m.
May	7.30 to 9 p. m.	December	4.00 to 9 p. m.
June and July	Straight rate of 12 cents at all times.		

Another of the twelve cities has a system of rebates on annual consumption, on a money basis. The plant is leased by the city to a lighting company. It is one of the few cities in Germany that do not directly operate their own lighting plants.

Annual Consumption.	Per Cent. Discount.
$500 to $1,225	2
$1,225 to $2,500	5
$2,500 to $5,000	7½
$5,000 and over	10

Again in the case of one of the other cities the rate of discount is based on monthly consumption of energy used either in residences or factories:

Monthly Consumption.	Per Cent. Discount.
Under 100 kw-hours	12½
Minimum of 100 kw-hours	11½
Minimum of 300 kw-hours	10
Minimum of 500 kw-hours	9½
Minimum of 1,000 kw-hours	8½

The following prices are charged per kw-hour for electrical energy for lighting purposes in the twelve largest cities in Germany:

Hamburg—14.3 cents; up to 10 per cent rebate on value of amount used.

Hanover—9.5 cents.

Bremen—16.7 cents; price reduced to 12.9 cents for rest of year after 3000 kw-hours have been used or after an amount of energy equivalent to the use of the consumer's entire installation for 400 hours has been recorded; after both conditions fulfilled price reduced to 5.7 cents.

Berlin—9.5 cents. A discount is given on yearly values used—i.e., 5 per cent on first 10,000, increasing the rebate 2½ per cent for each additional 10,000 up to 50,000, after which the increase is 2½ per cent for each additional 25,000. For municipal power and lighting purposes a much lower rate is given.

Magdeburg—11.9 cents; reduced to 9.5 cents for amount used above 1000 kw-hours.

Frankfort—11.9 cents; is reduced 2.4 cents for each 10,000 kw-hours used.

Dresden—11.9 cents; with 3 per cent to 20 per cent rebate on value of amount used.

Breslau—7 cents for openways and stairways; 11.9 cents for dwellings and factories.

Cologne—11.9 cents, average from 4:30 to 9 p. m.; all other hours 4 cents per kw-hour.

Chemnitz—11.9 cents. The rate is lower for amounts above 100 kw-hours.

Munich—14.3 cents; rebate from 1 per cent to 13 per cent on value of amount used from 1000 kw-hours to 50,000 kw-hours.

Leipzig—14.3 cents from 4 to 8 p. m.; all other hours 5 cents per kw-hour.

Wiring and Illumination

TUNGSTEN CLUSTERS MOUNTED ON TROLLEY POLES.

By W. B. Foshay.

There has always been a strong feeling that it is not at all practical to use the multiple type of tungsten lamp except where it is not subjected to vibration or sudden jarring. For that matter, it is still considered necessary by many to employ shock-absorbers with lamps of this type when used in places

Tungsten Cluster on Trolley Pole.

where they are subjected to more or less vibration. In the case of installing cluster or bracket lamps on trolley poles it has become the rule to specify some shock-absorbing device when multiple tungsten lamps are to be installed.

The city of Walla Walla, Wash., is considering the installation of three-cluster brackets, to be mounted on the trolley poles already installed on the main street of that city, and as a demonstration the local lighting company has installed six clusters of this kind. The brackets are made in two parts and are bolted together on the pole, making a fine appearance. It was necessary that an economical method of installation be devised, as the city is limited as to the amount it can spend for lighting. The feed wires were therefore installed overhead, a single braided duplex twin conductor being strung on the top of the iron trolley poles. The lamps in the fixtures are fed by means of wires run down inside of the poles to the point where brackets are mounted, and then brought out through the side of pole and around to the three sockets, the fixtures being of such a design as to allow the wiring to be entirely concealed. The brackets are so mounted that two lamps are over the sidewalk and one over the street.

The lamps used in this demonstration are the 60-watt multiple tungsten type. The outer globes are 12-inch opalescent balls. During 872 hours that the demonstration has been under way four lamps have burned out and one was broken through the breaking of the outer globe. The jar of the post caused one of the globes to fall, but the lamp in this case was not injured. The filament of none of the eighteen lamps had been affected by the vibration caused from the operation of the trolley cars. In this installation the sockets are screwed directly to the hood of the shade holder and no shock-absorbing device has been installed. The city is figuring on installing 136 of these clusters, and if this is done the entire number will be installed in the same manner as the six under experiment.

The writer has always had more faith than even the manufacturers themselves in the use of tungsten lamps on drop cords and in the old type of fixtures, where the lamp is not in a vertical position. Since the fall of 1907 he has had lamps used under these conditions in his own home and has been able to get a life of from 1100 to, in one case, 3000 hours. It is interesting to note that the latter was one of the first lamps commercially manufactured in this country, and was in daily service from December, 1907, to September, 1910, and for over five months on a drop cord.

The price made the city, including installation, maintenance and renewals, is $36 per cluster per year on a three-year contract, $33 on a five-year contract and $30 on a ten-year contract for all clusters on trolley poles. Where poles are put in also the price, on a ten-year basis only, is $34.50 per year. There will be six poles to a block, and the lamps will burn from dusk to midnight, except that the lamps on one pole at each corner, or at least one to the block, will burn all night.

WIRING OF A NEW YORK LOFT BUILDING.

By John P. Morrissey.

In the recent upheaval of the manufacturing and business interests of New York to get away from the downtown district a number of office and loft buildings have been erected and very quickly occupied along Fourth Avenue. In the shadow of the Metropolitan Tower is the nineteen-story loft building at 334 Fourth Avenue on the southwest corner of Twenty-fifth Street. The building throughout is of the highest grade in its construction and equipment. There are four electric passenger elevators and three electric freight elevators, which were manufactured and installed by the A. B. See Elevator Company. The elevator installation is of the electric traction type, operating at 400 ft. per minute, lifting 2500 lb., with motors on the roof. For the tenant occupying the first floor and basement there is an electric sidewalk lift running between the sidewalk and the basement. The owner has installed for his own use an electric sidewalk lift, which travels from the boiler-room level to the sidewalk.

The electric equipment in the building is of the highest type and grade. The energy is taken from the street service to the service board in the sub-basement from the underground mains of the New York Edison Company, and is carried to the main switchboard, also in the sub-basement, where it is distributed. Provisions are made on this switchboard for controlling the output of a future power plant. The service board is set in a

vault off the boiler-room on the Twenty-fifth Street side, where the service enters. It is a panel of polished, marbleized slate having mounted upon it two service switches and proper bus-bars and fuse posts to divide the service into three-wire, 220-110-volt circuits for lamps and two-wire, 220 volts for motor circuits. This division at this point eliminates the possibility of the drop in the motor feeders, which is at times great, due to sudden motor loads in a building of this type, from affecting

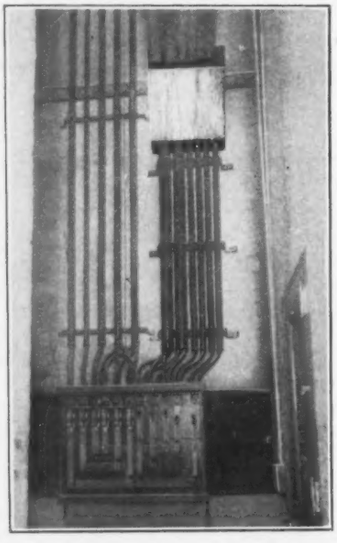


Fig. 1—Service Entrance and Pull Box.

the voltage of the lamps. The service board is inclosed in a wooden cabinet lined with sheet iron and having doors arranged so that the switches will be accessible in case of fire. The service feeders are run in iron conduit exposed on the ceiling. These service conduits are exceptionally large because the cables had to be arranged so that alternating current could be used in the building. The feeders that run to the switchboard from the service board are lead-covered and are composed of two 1,400,000-circ. mil cables for each of the three legs of the lighting feeder and two 1,400,000-circ. mil cables for each of the two legs of the motor feeder.

The switchboard is situated in the engine-room. A private generating plant is contemplated and all arrangements have been made for its future installation. The feeder section of the switchboard has been set with respect to the future engine and generator layout. The switchboard is made of 1½ in. polished marbleized slate set on an angle-iron frame embedded in the floor and securely braced to the walls. All switches, meter connections and other metal on the face of the board are of finished, polished copper. Each of the switches and meters has a name-plate. The switches are connected to the respective feeders at the back of the board by round copper rods running vertically from the switch lugs to the top of the board, where they are held in place by a slab of marbleized slate, which is supported on angle irons bolted to the switchboard frame. Connectors are used to tie the feeder cables to the rods. The rods are covered with circular loom for their entire length. The connections between the meters and the switches are made with flat copper busbars, in many cases laminated. Each feeder has its own switch, three-pole for lamp circuits and two-pole for motor circuits. The meters that have been placed on the switchboards are for owner's lamps, superintendent's apartment lamps and owner's motor circuits. All other motor and lamp circuits are metered at the panels on different floors. The sides, top and bottom of the switchboard are covered with an electro-bronzed iron grille, one end having a door in it.

Above the switchboard a large pull box has been installed to which all feeders run from their respective riser shafts, motors and outlets. All crossing of cables has been done in this box. The feeders enter on the sides and front of the box, while from the bottom of the box the feeders are carried in conduit to a point above their respective lugs at the top of the board. This makes a very neat arrangement and a very safe one electrically. A section of the bottom of the pull box is removable so that the inside is accessible for future changes or additions. From this pull box the feeders run in conduit hung on the ceiling of the engine and boiler-rooms to their respective riser shafts and up to the distribution boxes, motors on roof and on different floors and in the engine-room. To avoid running conduits and cables across the tops of the boilers and among the steam mains to the north riser shaft a 14-in. cast-iron pipe was installed in the unexcavated ground, starting at the engine-room and ending in the rear of the boiler-room, in which all feeder conduits are installed. Pull boxes were placed at each end of this cast-iron pipe, thereby doing away with the numerous bends of conduit at each end.

The conduit used throughout the entire building is "Galvaduct" and "Sherarduct," manufactured by the Safety-Amorite Conduit Company and the National Metal Molding Company respectively. All conduit and pull boxes have been painted where they are exposed to agree with the surrounding finish. Where long runs of feeders have been made the feeders are anchored in anchor boxes, made the same as pull boxes and so placed that the feeders were supported at the proper length as required by the law. The anchor boxes for the south shaft are placed directly below the distribution boxes on the floors on which they occur. They are 6 in. deeper than the distribution boxes so that the cables do not pass through the distribution boxes. On the north shaft these boxes are so placed that the conduits run up alongside of the distribution boxes, as the space provided would not permit the conduits to run behind the distribution boxes as in the south shaft.

The distribution boxes are unusually large, as they are made to receive the center of distribution panel for lamp and motor

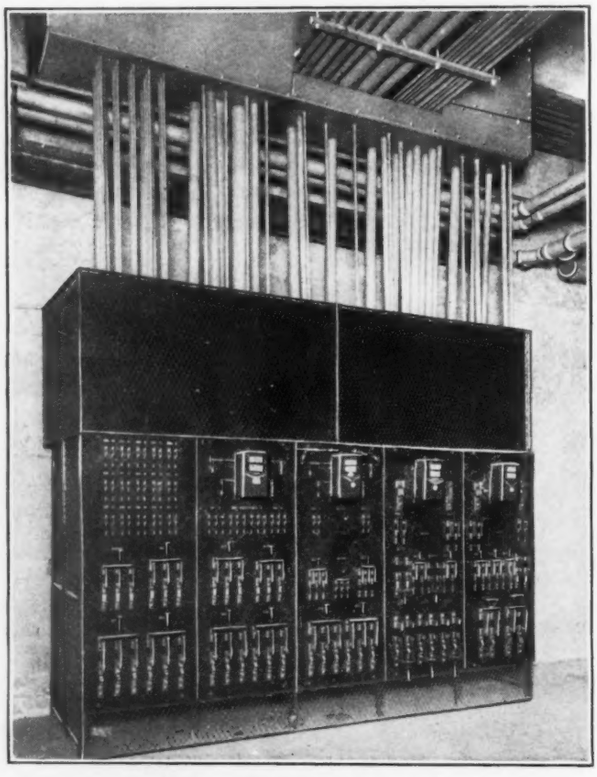


Fig. 2—Central Switchboard and Pull Box.

service at the top, which also includes the meter loops for both, the compartment and panel for meters, and the branch circuit panel for circuit switches. Besides these different panels a gutter space for the cables and wires adds to its size. The distribution boxes are 9 in. deep in order to accommodate the meters. The feeder and meter panels are placed on the back of the distribution box with a ½-in. air space between the panels and distribution box. The branch-circuit panel, being

only 5 in. deep, is set on band-iron brackets, which leaves a clear air space of 4 in. between this panel and the back of the distribution box. This space behind the panel is used for running the cables and wires. All large conduits are run in the rear of the bottom and top of the distribution boxes, and the small branch-circuit conduits in front of the bottom and top of the distribution boxes, thereby avoiding all unnecessary crossing of cables and wires. Out of the top of each distribution box is a 1.25-in. elbow with a bushing arranged so as to finish flush with the plaster. This is installed for any future motor wiring and avoids all cutting when the wire is installed. On all sides of the distribution box a ¾-in. angle iron is installed and bolted to the distribution box so that the trims could be properly fastened and securely held in place. The panels for the feeder buses, meters and branch-circuit switches are made of 1-in. polished, marbleized slate entirely inclosed on all sides with a ¼-in. polished, marbleized slate lining. Polished copper busbars have been installed on the feeder panel for lamps and motors with lugs on both ends. The incoming feeders connect to one end and the outgoing feeders, which loop to the panels of the other distribution box in the manner described, to the other end. Set on top of the feeder buses is a strip of marbleized slate on which are set the lamp and motor buses, lugs and fuses for the meter loops in the respective panels. The meter loops are run from their respective lugs through the meter compartment, thence to the lugs on the lighting panels, which are connected to the busbars that feed the branch-circuit switches. The switches are arranged on either side of the buses and are placed so that the fuses are dead when the switches are open. Each panel is provided with a few extra switches for future use. Each section of the distribution box is provided with a door properly lined, and each branch-circuit panel is provided with a lamp receptacle for lighting same. All metal on the panel is polished copper. A polished-copper frame holding a plate glass under which is a small drawing showing the outlets and wiring and the number of the switch controlling each outlet is on the door of the branch-circuit panels. The branch circuits are connected to the panel so that two two-wire meters may be installed instead of one three-wire meter for lamp circuits. By this arrangement one panel may be used for two tenants, a front northeast and a rear northwest on the north panel and a front southeast and a rear southwest on the south panel.

The wiring scheme from the service to the outlets is held to the simplest system. The service runs from the service board to the switchboard as hereinbefore described, then the lamp

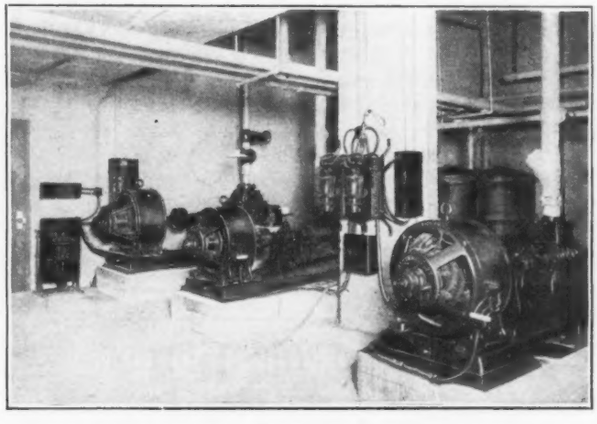


Fig. 3—Motor-Driven Pumps in Basement.

and motor feeders run from the switchboard to the distribution boxes, looping through each distribution box until a set is fed that the feeder has been designed for. Meter loops are then taken off as described and connected to their proper panels. The feeders are designed for a 3 per cent drop between switchboard and any lamp at full load and a 2-volt difference between any two lamps. The motor feeders for tenants are run one to each riser shaft, where it runs to a center of distribution on the ninth floor, from which mains are run, one up to the roof and the other down to the basement. The other motor feeders are run to their respective motors in the engine and boiler-rooms, also to the elevator and fan motors on the roof. A motor feeder is run up to a center of distribution on the tenth floor, where mains are run, one up to the roof and the other down to the basement, the mains looping through a small panel on each floor which contains a 50-amp, two-pole

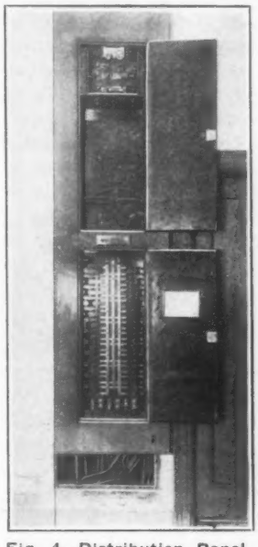


Fig. 4—Distribution Panel, Motor Box and Anchor Compartment.

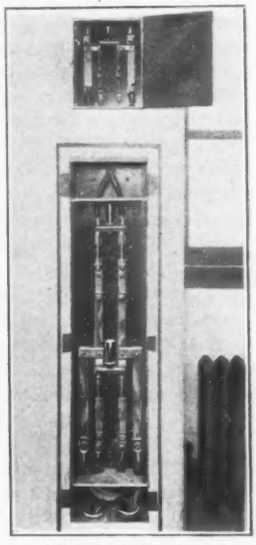


Fig. 5—A Center of Distribution.

knife switch. These switches are for future wiring for ventilating fans which may have to be installed as demanded by the factory laws of the State. Proper brackets have been hung from the ceiling at court windows for the fans. The motors in the engine-room are used entirely for pumping purposes; that is, house, fire, sprinkler and sump pumps. There are also some motor circuits for engine and boiler-room ventilating fans, also to the ash lift in the vault off the boiler-room. The starting apparatus for the various pumps is arranged for automatic operation by tank switches and also for hand starting by double-throw switches.

The owner has a three-wire lamp feeder going up to the panel in the south hall of the nineteenth floor, from which all the lamps in the machine-rooms, deck houses and public toilets are fed. On the nineteenth floor the superintendent's apartment has been laid out and the three-wire lamp feeder is run from the switchboard to a panel located in the hall of the apartment from which all the apartment lighting is controlled. The stair-lighting circuits are arranged on separate feeders, there being two three-wire feeders for the south stairs and one three-wire feeder for the west stairs. These feeders run from the switchboard up to their respective panels on the tenth floor, where two-wire branches are run to each set of outlets, one set going down from the tenth floor to the first floor with an outlet on each landing and the other set going up from the tenth floor to the roof with an outlet on each landing. The outlets are on the walls and are set 10 ft. above the landings and are controlled by lock switches directly below them set 4 ft. above the landing. The first-floor passenger and freight-elevator entrances are lighted by ceiling outlets arranged in the paneling in the ceiling. Each outlet is controlled by a lock switch set in the marble. In this gang of lock switches a switch is provided for the lamps in the elevator cars. The circuits that feed these outlets are run from the main switchboard. This arrangement of running branches and feeders from the main switchboard to the different panels and outlets in the owner's portion of the building gives the engineer entire control of same. The outlets in the engine and boiler-rooms are arranged in the ceiling and on the walls with respect to the present and future machinery and boilers. They are all controlled from the switchboard.

The lamp outlets on all floors are arranged one to the bay, each outlet of 660-watt capacity and controlled by a two-pole knife switch on the panel board. The conduit is run ¾ in. to the first outlet from the distribution box and ½ in. between the first and second outlets. Two duplex wires are pulled into the ¾-in. conduit to the first outlet, one duplex wire stopping and the other duplex continuing on through the ½-in. conduit to the second outlet, where it terminates. This arrangement was followed so as to cut down the number of conduits going into the top of the distribution box, as each panel controls an average of twenty-six circuits throughout the building. During the building construction the outlets and conduits between outlets, with a length of conduit started toward the distribution box, were installed on the forms that were put in place to construct the concrete arches. After the concrete had been poured and set the forms were removed and the conduit ends picked up and continued back to the distribution boxes. This method of installation was found to be very satisfactory, as the cutting of the concrete, after it has set, is very laborious and cannot be done in a satisfactory manner. The wire used throughout the job is the best copper, 98 per cent conductivity, with an insulating compound of 30 per cent Para rubber of the best quality, this being protected by a moisture-repellant covering composed of two grades of cotton.

The local switches throughout the building are of the Metropolitan detachable pattern. All switches on the stairs, in the halls and in the public toilets are of the lock type, and all switches in the tenants' property are of the push type.

A conduit system has been installed for the public telephone cables. A 2-in. conduit is run from the terminal board in the engine-room to each riser shaft, one at a column on the north wall and the other in the partition of the toilet-rooms west of the south electric riser shaft, looping through a box on each floor. Each box has a brass cover with properly bushed holes for future extensions. A similar arrangement has been installed for the ticker, telegraph and other miscellaneous wires. That is, a 2-in. conduit is run at the same points and connected in the same manner.

An intercommunicating telephone system has been installed for the working force of the building and telephones have been connected at the following points: Engine-room, passenger elevator hall, first floor; freight elevator hall, first floor; passenger elevator machine-room on the roof; freight elevator machine-room on the roof, and in the superintendent's apartments on the nineteenth floor. The electric bell system in this building is not extensive, but necessary. A push has been installed at each entrance connected to a bell and annunciator in the engine-room. A push at the Fourth Avenue entrance is connected to a bell in the superintendent's apartments on the nineteenth floor. At each sidewalk lift a push has been installed at the street level connected with its respective bell. In each elevator a push has been installed which rings a bell and registers on the annunciator in the engine-room, thus giving the elevator operator a means of calling the engineer in time of trouble. A push has been installed at the entrance of the superintendent's apartments connected to a bell in the apartment. The batteries for the bell and telephone system are composed of Sampson No. 3 cells of a proper number to operate the respective system. They are set in hardwood boxes placed on the wall of the engine-room. Each system has two sets of batteries so as to have a reserve set to operate with. The pushes are of the sliding-contact, platinum-tipped type except the outside pushes, which are waterproof.

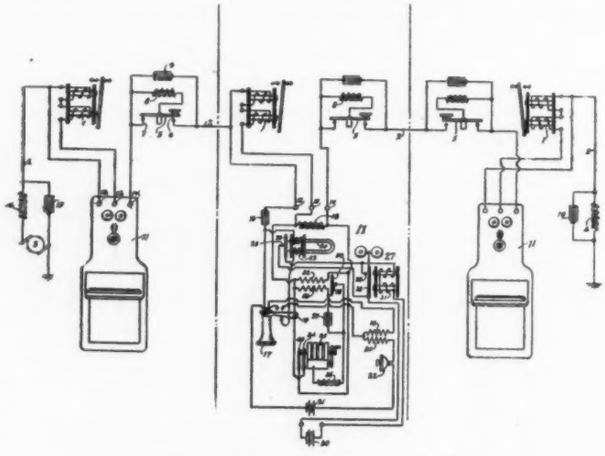
In addition to all the precautions that have been taken against the spread of fire, a fire-alarm system has been installed. On both stairways at the floor landings there is a station of the break-glass pattern, which is connected with the city fire-alarm system. Stations have also been located on the lower floor. Preparation has been made for a watchman's supervision system. An outlet has been set on each stairway at the floor landing so that a flush-type magneto-key station may be installed and the master clock arranged for in the superintendent's apartments. Stations have also been located on the lower floor.

The building was designed and the construction supervised by Messrs. George B. Post & Sons, architects. Messrs. Pattison Brothers were the consulting engineers, the Andrew J. Robinson Company was the builder and the L. K. Comstock Company the electrical contractor.

RECENT TELEPHONE PATENTS.

COMPOSITE SYSTEM.

In Fig. 1 is shown a composite system suitable for railway work which has been patented by Mr. O. M. Leich, of Genoa, Ill., his patent having been assigned to the Cracraft-Leich Electric Company. It is essential with such systems that the telephone apparatus provide a continuous path for telegraph currents whether or not in use. Similarly the operation of the telegraph keys must not open the line to telephone currents. In addition, the telegraph circuit must contain enough impedance to prevent sudden current changes which will disturb the telephone system. In the system shown the telegraph circuit may be traced from the grounded generator through the telegraph relay, through the coil cut in between the right-hand binding posts of the telephone through the telegraph key, etc. It must, of course, be assumed that the telegraph key is normally closed instead of open, as shown. It will also be seen that the telephone tap to the left-hand binding post of the set meets a condenser. The operation of any telegraph key, in dropping it against the back stop, opens the circuit simultaneously, short-circuiting the key coil so as to take up the inductive "kick."



Composite Telephone and Telegraph System.

The telephone instrument is shown with a high-frequency interrupter for telephone signal purposes. Currents produced by this and the hand generator in co-operation will follow the telephone circuit and not interfere with the telegraph. These as well as the telephone currents are obstructed by the retardation coils but pass freely through condensers.

LETTERS TO THE EDITOR.

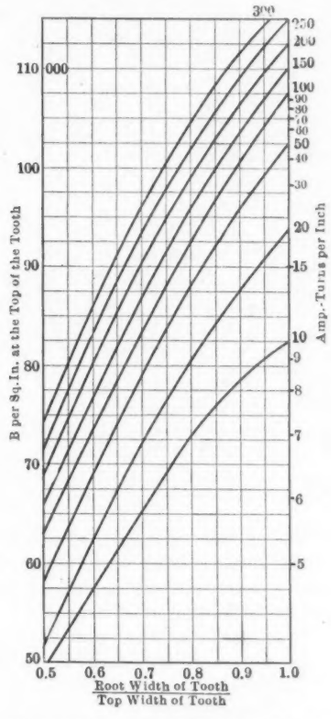
Magnetomotive Force in Non-Uniform Magnetic Paths.

To the Editor of Electrical World:

SIR:—I have read with much interest the article in your issue of Jan. 12 by Mr. A. Miller Gray describing a method of calculating the ampere-turns required for the armature teeth of direct-current machines, which the author designates as a "new method."

In the latter part of 1904, when confronted with the task of working out a system for the calculating department of the

Johnson-Lundell Electric Traction Company, of London, I felt dissatisfied with the methods given in the handbooks for the determination of the ampere-turns needed for the teeth, and I directed my assistant, Mr. Allan Berlin, now connected with the Swedish Patent Office, to work out a set of curves



Curves for Amp-Turns for Teeth.

similar to those now given by Mr. Gray. We first obtained a magnetization curve of the particular iron we used for armature disks and then, choosing a certain ratio between top and root of the tooth, we marked on the magnetization curve a series of top densities and corresponding root densities and integrated the areas, thus obtaining the average ampere-turns. We plotted the results in a manner similar to that of Mr. Gray except that we used the top density instead of the root density as a basis, and also drew ampere-turn curves on the ratio of root to top as abscissa and the top density as ordinate. I happen to have a duplicate of this latter curve, which I inclose.

At about the same time we worked out these curves Mr. Henry M. Hobart published his book on motor construction, in which the leakage at high densities was emphasized and some corrections suggested, based on experimental data, if I am not mistaken. We then were thinking of recalculating our curves applying the corrections suggested by Mr. Hobart, but on further consideration we decided that owing to the numerous uncertainties in determining the correct ampere-turns for other parts of the circuit due to inaccuracies of air-gap, pole-tip distribution, variation of permeability of iron, etc., an attempt at great accuracy at this one particular point would be wasted.

These curves, once worked out, greatly facilitate calculations. They also furnish more correct and safer figures than the other methods. When the ratio of top to bottom (as used by Mr. Gray) is large, as, say, 1.6 to 1.7, which sometimes occurs, the ordinary methods give results that are too low to be safe. The magnetic leakage at high densities makes the results obtained from the curves still safer.

Davenport, Ia. J. GUSTAF V. LANG.

Permanent Cast-Iron Magnets.

To the Editor of Electrical World:

SIR:—I note in the Digest in your issue of Jan. 12 the late arrival of our esteemed English friends in developing and describing a method for making cast-iron permanent magnets. Approximately twelve years ago the late Prof. H. A. Rowland, of Johns Hopkins University, experimented extensively and successfully in making permanent cast-iron magnets. For over ten years practically all the galvanometer magnets used by one of our leading manufacturers of electrical instruments were made according to the Rowland method, which is precisely that described by our English friends, except that the "chemical bath" instead of being a mystery may contain anything, as salt, sulphuric acid or copper sulphate, which renders the water an electrolyte, this being assumed to abstract heat from the casting rapidly. Pure cold water serves first rate.

Princeton, N. J. E. F. NORTHRUP.

General Pleasanton and the Army Mule.

To the Editor of Electrical World:

SIR:—The editorial in your issue of Jan 19 on excessive illumination as a cause of eye-strain is surely excellent and sounds a much-needed warning. But isn't it just a little severe on General Pleasanton and the "blue-glass cure"? On your discussion, in so far as it is based upon editorial acquaintance with the general's mule admittedly more intimate than mine, I make no comment; but Prof. Niels R. Finsen, certainly an authority on all branches of light-therapy, said in 1903 that "the general was absolutely on the right track, however short a distance he went." As Dr. Finsen cured several hundred cases of lupus by light-treatments, prior to his lamented death, and practically stopped the ravages of that awful disfigurement, his opinion is entitled to respect, as you would be the first to admit.

New York. T. J. JOHNSTON.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Rotary Converter.—L. DREYFUS.—A paper in which the author describes the complete diagram of the polyphase rotary converter for changing polyphase alternating current into direct current. The diagram is given in such a form that it includes all possible uses of the machine. The author first discusses the ohmic voltage drop and the copper losses of the alternating-current side; secondly, the ohmic voltage drop and the copper losses in the direct-current side; thirdly, the armature reaction, and finally describes the vector diagram. The problem is reduced to the general theory of synchronous machines.—*Elek. Zeit.*, Jan. 5.

Prevention of Induced Currents in Shafts and Bearings.—A note on a recent British patent (7463, Dec. 29, 1910) of the Felten & Guilleaume Lahmeyerwerke A.-G. In order to neutralize the e.m.fs. induced in shafts and bearings by the fluxes which pass through these parts a winding is arranged on the stator in such a way that an e.m.f. is induced in it by the influence of the same field fluctuations which produce the shaft voltage. The winding is short-circuited and counteracts the field fluctuations which induce currents in the shaft.—Lond. *Elec. Eng'ing*, Jan. 5.

Mercury-Vapor Rectifiers for Large Outputs.—BELA B. SCHAEFER.—The output of the ordinary mercury-vapor rectifier

is limited by the use of glass tubes and the difficulty of maintaining the vacuum. The chief features of the author's improvements are the use of a steel tube instead of a glass tube and the method of making it air-tight by means of asbestos and mercury. The steel tube has a diameter of 170 mm (6¾ in.). The vacuum can be maintained quite successfully. The arrangement of the electrodes and their details of construction are described at some length and oscillographic diagrams are given of the currents and voltages. The efficiency of the mercury-vapor rectifier is mainly determined by the voltage drop in the vapor space. This is about 15 volts and is

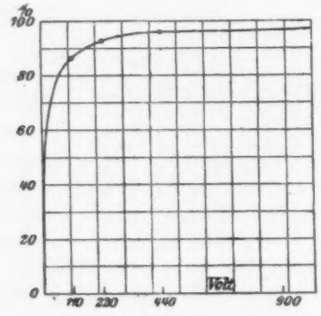


Fig. 1—Efficiency Curve.

practically independent of the current and of the voltage. For this reason the efficiency is the higher the higher the voltage of the circuit and is almost independent of the load. Fig. 1 shows the efficiency as a function of the voltage, the losses including those in the exciter, but not those in the transformer, which is used for dividing the voltage into two halves. Fig. 2 gives in curve *a* the efficiency of the mercury-vapor rectifier for varying sizes, all losses being included. For comparison with this curve *a* for the mercury-vapor rectifier the corresponding efficiency curve *b* for rotary converters with the same normal rating and for an e.m.f. of 220 volts is given. The efficiency of the mercury-vapor rectifier is considerably higher. As there are no moving parts the wear and tear is small. There is little expense for attendance and the apparatus works without noise.—*Elek. Zeit.*, Jan. 5.

The Best Thickness of Iron Sheets.—E. Jasse.—The author shows that the best thickness for iron sheets of electromagnetic apparatus can be easily calculated approximately as follows. The rule is that the iron losses become a minimum when the ratio of 80 per cent of the hysteresis loss to the

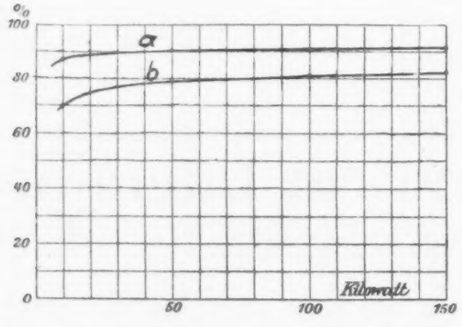


Fig. 2—Efficiency Curves of Rectifier and Converter.

eddy-current loss equals the ratio of the thickness of the iron sheets to the thickness of the paper.—*Elek. Zeit.*, Dec. 29.

Stray Flux of Induction Motor.—W. Rogowski.—The conclusion of his mathematical paper. The value of the leakage coefficient is expressed by the magnetic energy of the no-load and the leakage fluxes and on this basis the influence of the slot dimensions and of the saturation of the teeth is discussed. A numerical example is added.—*Elek. Zeit.*, Dec. 29.

Lamps and Lighting.

Quartz-Tube Mercury-Vapor Lamp.—An illustrated description of the "quartzlite" lamp, which is the latest form of Bastian lamp and contains a tube of quartz. As the current density is high this tube is quite short, even for circuits of from 100 volts to 250 volts. "The spectrum is further improved by the use of tantalum for the metal electrode." One result of using quartz is that a large proportion of ultra-violet light

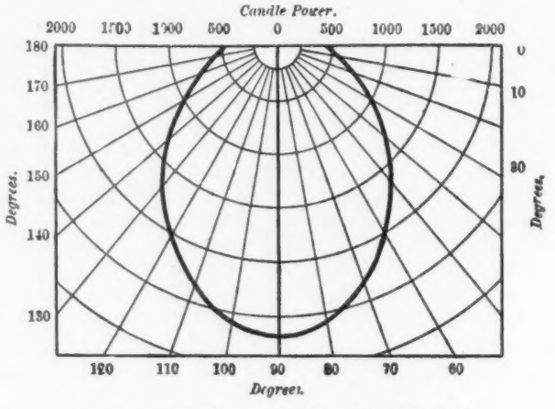


Fig. 3—Distribution of Light with Opal Globe.

is transmitted, and as this may have a harmful effect on the skin it is essential that an outer glass globe should be used. The rated candle-power of the standard 3.5-amp lamp varies from 1800 to 2500, according to the pressure of the circuit. The process of switching on the lamp allows the current to pass through the shunt-tilting solenoids, which tip up the burner so as to cause the mercury momentarily to connect the electrodes. The solenoids being thereby put out of action the burner is allowed to fall to its original position, an arc being formed between the positive electrode and the retreating mercury. At the moment that the two electrodes of the burner are connected by the stream of mercury a small electromagnet in series with the burner opens the shunt circuit and thereby disconnects the tilting coils. Immediately, however, that the main circuit is interrupted the cut-out switch falls by gravity, so that the tilting circuit is ready to operate again. A metallic reflector is placed over the burner. Fig. 3 herewith shows the distribution of candle-power in a quartzlite lamp, rated at from 3 amp to 3.5 amp at 220 volts. The test was carried out at the National Physical Laboratory. The lamp was fitted with

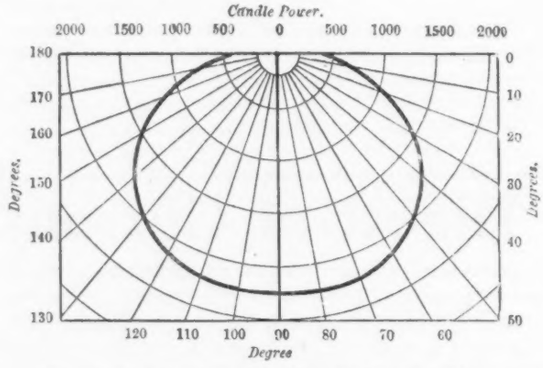


Fig. 4—Distribution of Light with Frosted Globe.

an opal globe. The mean hemispherical candle-power was calculated to be 1220, the maximum vertical illumination being 2700 candles. In a further test, when a frosted globe was used, the mean hemispherical candle-power was found to be 1480, so that the lamp gives more than 2 cp per watt. The distribution of light with the frosted globe is shown in Fig. 4.—Lond. *Electrician*, Jan. 6.

Neon Tube Lamp.—G. Claude.—A French Academy paper

on further improvements of the neon tube lamp. Additions of foreign gases to the neon gas in the tube must be carefully avoided, since a few per cent only of nitrogen is sufficient to reduce the luminous output very essentially. The author makes use of the observation of Dewar that at exceedingly low temperatures (liquid air) charcoal absorbs gases rapidly; but neon is absorbed to a smaller degree than other gases. The light of the neon tube is rich in red rays and thus forms the counterpart of the mercury-vapor lamp. The author's neon tube has a length of 6 m (19½ ft.) between electrodes and a diameter of 45 mm (1¾ in.). The potential difference at the terminals of the tube is 1000 volts and is almost independent of the current, decreasing from 1100 volts to 980 volts when the current is raised from 0.1 amp to 1 amp. With a potential difference of 1000 volts and a current of 0.94 amp the effective power is 850 watts, the power-factor being 0.9. The tube gives 220 cp per meter (or 67 cp per foot) or 1320 cp for its total length, corresponding to a specific consumption of 0.64 watt per candle-power. This does not include the losses in inductance coil and transformer. If these are included the specific consumption is 0.8 watt per candle-power. But the author hopes to reduce this to 0.5 watt per candle-power. In an editorial note J. Blondin states that the neon tube lamp has passed the laboratory stage and that several neon tubes have recently been employed successfully side by side with nitrogen-vapor tubes for exterior illumination at the Paris Automobile Show.—*La Revue Elec.*, Dec. 30.

Generation, Transmission and Distribution.

Three-Phase Induction Motors in Mining.—P. HERD.—A paper in which the author discusses in a general manner some of the characteristics of three-phase induction motors and the bearing these characteristics should have in determining the rating and speed of motors to be installed. The subject is discussed under the following heads: No-load current; three-phase motors operating on unbalanced circuits; voltage variation; variation of frequency; choice of rating and speed of motors. In mining and metallurgical practice steam-mill, tube-mill, tailings-wheel or tailings-pump motors operate for twenty-eight and one-half days per month on an average, representing 342 days per year, so that the importance of installing high-efficiency motors to drive them is obvious. The author gives a numerical example showing that the expenditure of some more money on the first cost of the motor may result in a much greater yearly saving in the cost of energy consumed. The author emphasizes the necessity of installing the most efficient motors obtainable and the relatively unimportant bearing the question of low first cost should have in determining the type of motor to be installed to operate machines that will be in service for the long periods that obtain in mining practice.—*Trans. South African Inst. Elec. Eng.*, November, 1910.

Electric Winding.—An account of the extended discussion which followed the recent paper of Wilson before the Newcastle Section of the (British) Institution of Electrical Engineers. T. C. Futers objected to many electric winders on account of the complications and criticised at some length the Koepe pulley and the Ilgner system. On the whole he thought it better to retain steam winders and utilize the exhaust in a low-pressure turbine. M. Kirby gave the following figures for the cost of steam winding from actual practice in England: In one case the gross cost is 4.868 cents per ton per 1000 ft. and in another case 5.48 cents. H. A. Couves said that there is a large demand for electric winders of small output; many collieries in northern England are working at from 700 tons to 800 tons per day, winding from 600 ft. to 700 ft. Colliery companies have been well advised not to put in electric winders if energy must be generated privately, but the case is different where a public supply is available. Many old steam winders still working ought to have been scrapped long since; the installation of electric winders in their place would not be expensive, as most of them could be run as three-phase geared machines. Schuil referred to the use of buffer storage batteries for equalizing the load and to the power-factor of induction motors at starting. W. C. Mountain gave figures showing that in many cases electric winding cannot compete with steam winding. There are cases, however, where electric winding, especially for small duties, can effect considerable saving. —Lond. *Elec. Eng'ing*, Jan. 5.

Transmission Systems for Agricultural Districts.—C. SCHMIDT.—A discussion of the most favorable voltage and other points in the design of transmission systems for agricultural districts. The author emphasizes that for such transmission systems small consumers are of great importance and their easy connection at a later date should be taken into consideration in the first design. It must be possible without high cost of the distribution network to operate several electric plows simultaneously and besides this to permit another high load on the same circuit. Further, it must be possible to connect small consumers without great expense. The author shows how such considerations influence the choice of voltage, etc.—*Elek. Zeit.*, Dec. 29.

Traction.

Fifty-Cycle Single-Phase Traction.—P. MUELLER.—An illustrated description of the street-railway system of San Avold in Lorraine, Germany, which connects the town with a railroad station at a distance of 2.6 km (1½ miles). The road has considerable grades and curves. This is the first road in Germany which is operated by single-phase currents with the frequency of 50 cycles. Three-phase energy at 5000 volts and 50 cycles is bought at the price of 1.75 cents per kw-hour and one phase of the three-phase circuit is utilized for traction. Two transformer stations are arranged along the road. The motors are six-pole repulsion motors of the Bergmann Company. The electric equipment and the construction of the motors are described in some detail, and the advantage of the possibility of connecting a tramway directly to an existing three-phase transmission system is pointed out.—*Elek. Zeit.*, Jan. 5.

Single-Phase Locomotive.—An illustrated description of a 2000-hp, 15,000-volt, single-phase locomotive of the Oerlikon Company which is claimed to be "the locomotive of the least specific weight." The driving equipment when supplied with single-phase current at 15,000 volts and a frequency of between 13 cycles and 17 cycles per second can exert a power of 2000 hp continuously with a speed of twenty-six and one-quarter miles (42 km) per hour and a tractive effort of 13 tons at the road wheels. The speed can be regulated from nothing up to forty-three and three-quarter miles (70 km) per hour. The tractive effort at starting may become a maximum of 15 tons. The axle pressure is 15 tons, the total weight of the locomotive 88 tons, the adhesive weight 88 tons, or six and seven-tenths times the normal tractive effort. The total length is 50 ft. (15 m). Should the speed at which the normal tractive effort is reached become too near the maximum speed the latter can be increased by modifying the secondary transformer winding so that 3000 hp can be exerted for an hour at a speed of thirty-seven and one-half miles (60 km) per hour. The locomotive can also be operated with three-phase currents and with direct current. The motors are of the twelve-pole compensated-series type with compensating field coils.—Lond. *Electrician*, Jan. 6.

British Traction Statistics.—The annual statistical tables giving details of equipment and operation of 138 British tramways and light railways receiving energy from combined lighting and traction power houses, forty-eight tramways and light railways with power houses for traction only and sixteen electric railways in operation.—Supplement to Lond. *Electrician*, Jan. 6.

Electric Transmission on Shipboard.—F. NIETHAMMER AND E. SIEGEL.—An article on systems combining oil or gasoline engines with electric transmission for the propulsion of ships. The authors discuss briefly the many different methods of reversal of direction and speed regulation both for direct current and alternating current.—*Elek. Kraftbet. u. Bahnen*, Dec. 4.

Installations, Systems and Appliances.

Switchgear for Mines.—G. STEVENSON.—A note on a paper read before the Mining Institute of Scotland. The author dealt first with the details of the switches used for underground

work and considered the design of three-phase equipment in particular, as this system is considered to be preferable for employment in mines. Knife-blade switches with an air-break were first used, a pattern which had the double disadvantage of occupying a great deal of space and giving rise to dangerous arcing. They were, therefore, soon abandoned and replaced by oil-break switches, which still hold the field. To this simple switch have been added a multiplicity of automatic features, the use of which is not to be commended for mining work. Two overload trips are in general quite sufficient for the purpose, except where the neutral point of the system is earthed, when an extra one becomes necessary for adequate protection. The cardinal points in the lay-out of mining switchgear are safety, reliability and simplicity, and these can all be obtained by using oil-immersed iron-clad switchgear. As regards the switchgear to be used on the surface the same conditions should be fulfilled by it as by that underground. Well-designed boards built of substantial slate panels, mounted in an iron framework and arranged so as to keep all "live" metal away from the front of the board, make quite a satisfactory equipment. Each item of equipment should be inclosed in a separate and self-contained fireproof cell constructed of molded stone. In conclusion the author said sufficient attention had not been given in the past, in collieries generally, to the question of switchgear, with the result that low initial cost has been a deterrent factor. But the urgent necessity of raising the standard of the equipment is now being recognized.—Lond. *Electrician,* Jan. 6.

Protective Gear.—K. Faye-Hansen and G. Harlow.—A paper read before the Manchester Section of the (British) Institution of Electrical Engineers on the Merz-Price protective gear and other discriminative apparatus for alternating-current circuits.—Lond. *Electrician,* Jan. 6.

Wires, Wiring and Conduits.

Cables.—F. Fernie.—The continuation of his long illustrated serial on electric cables. In the present instalment the author deals with fault localization on three-wire and three-phase networks, the conditions which should be fulfilled to obtain satisfactory practical operation being stated. The procedure which should be followed in fault localization is also given in a general way.—Lond. *Electrician,* Jan. 6.

Bare Neutral Wire.—E. W. Weinbeer.—The Peschel system of wiring in which slotted steel tubes (joined together by simple overlapping) without insulation are used for the protection of rubber-insulated wires is used to a considerable extent in Germany and it has become usual in recent years to use the tube for the return circuit. Since the joints are simply produced by overlapping the tubes the question of the voltage drop is of importance. The author gives the results of tests in practice in which such tubes were used as earthed neutral wires or as return circuits and shows that the voltage drop is in all cases far below the maximum permissible limit. For this reason the use of the Peschel tubes as neutral wire or return conductor offers no difficulties.—*Elek. Zeit.,* Dec. 29.

Calculation of Overhead Lines.—A. Blondel.—An easy method of calculating overhead transmission lines by means of a single diagram was described by Blondel at the "White Coal Congress" in 1902. His work has later been extended by him and others. In the present article the principal parts of the original paper by Blondel, together with the diagram, are reproduced.—*La Lumière Elec.,* Dec. 31.

Electrophysics and Magnetism.

Stretching of a Conductor by Its Current.—C. Hering.—A paper in which the author gives reasons why one should expect a current to develop an axial force in its conductor tending to straighten and stretch it. Some experiments are described which are directly explained by the conception of the lengthening of the circuit by the current, while the older notion of an increase of the area inclosed by the circuit due to the current is not in accordance with these experiments. The following conclusions are drawn: In a conductor free from all external influences a current exerts a stretching force, due to its magnetic effect, which is independent of the direction of the current or of the length of the conductor and is presumably proportional to the square of the current and inversely proportional to the cross-section; it continues to act, no matter to what length the conductor has been stretched by it, and is therefore not of the nature of a strain; it is affected by neighboring currents and becomes less as these neighboring currents neutralize the magnetic effect of the current, being zero in a perfectly non-inductive circuit; when it produces motion a counter e.m.f. is produced; when such motion is reversed by a stronger opposing mechanical force a direct e.m.f. is produced.—*Jour. Franklin Inst.,* January.

Radiation.—T. Royes.—A note on experimental determinations of the reflective power of lamp-black and platinum-black. The results are interesting, as they have a bearing on the laws of radiation. Kurlbaum's determinations of the constant in the Stefan radiation law were not corrected for the reflective power of platinum-black. If this correction is made Kurlbaum's value, 7.061×10^{-15}, is to be corrected to 7.10×10^{-15} ergs per centimeter square $\times$ fourth power of temperature degrees. Planck's value for the elementary quantity of electricity is consequently increased in the same ratio and becomes 4.624×10^{-10} electrostatic unit.—*Phil. Mag.,* January.

Magnetic Properties of Silicon-Iron Alloys.—S. Guggenheim.—His complete paper with illustrations on the magnetic properties of silicon-iron alloys and their uses in electrical engineering. An abstract of this paper has already been noticed in the Digest.—*Elek. Kraftbet. u. Bahnen,* Sept. 24.

Magnetism.—D. Owen.—The author continues his summary of the late Professor Curie's work on magnetism. The results arrived at for a number of bodies are given, including water, sulphur, phosphorus, bismuth, oxygen, ferrous sulphate and ferromagnetic bodies. Langevin's theory is considered and reference made to Weiss' work.—Lond. *Electrician,* Jan. 6.

Electrochemistry and Batteries.

Primary Cells for Telephone Purposes.—J. G. Lucas.—A long abstract with illustrations of his recent paper before the Institute of British Post Office Electrical Engineers on experiments carried out by the author and A. Fraser on primary batteries used in telephoning. The main conclusion arrived at is that by the substitution of powdered manganese dioxide for the comparatively large granules of manganese dioxide usually employed the ordinary porous-pot Leclanché cell is enormously

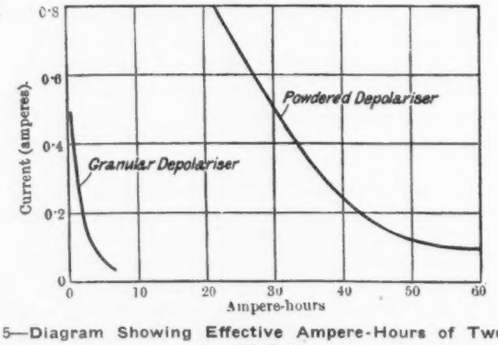


Fig. 5—Diagram Showing Effective Ampere-Hours of Two Leclanché Cells.

improved, so much so that there is little doubt that cells so constructed will largely displace all other patterns, both wet and dry. Fig. 5 gives the results of discharging two No. 1 Leclanché porous-pot cells, exactly similar in every respect, except that in one the manganese dioxide is powdered and in the other merely granulated. The weights of material were identical and in both cases the cells were discharged for five hours a day and six days a week. A maximum drop of 33 per cent in the voltage was allowed in this test. The results of other tests are also given in diagrams. Some of the tests refer to dry cells. The author attributes the larger number of amp-hours obtainable in the case of the Siemens than in the Fuller dry cell to the fact that the Siemens depolarizer is more finely powdered and thus forms a more compact mass, so that the gases escape more slowly and carry off less moisture; the cell, therefore, does not dry up so quickly. The occasional bursting of the Siemens cells may be due partly

to this cause and partly to the formation of crystalline bodies within the zinc canister. Up to a certain point the effective amp-hours of the dry cells actually rise with increased current; this is due to the rise in resistance (caused by drying up) making it necessary to discard the cell after it has been in use for a certain period, and at the low discharge rates the amp-hours developed in that period are, of course, less. The superiority of the Siemens cell is also shown; it has a far longer life than the Fuller on the lower discharge rates. The paper also gives some particulars with regard to the substitution of manganese chloride for ammonium chloride as the electrolyte in the wet Leclanche cell. The author has made this charge to prevent the evolution of ammonia gas. The absence of this gas renders it unnecessary to ventilate the boxes of subscribers' batteries and therefore diminishes evaporation and "creeping," so that a considerable saving in maintenance costs is expected.—Lond. *Elec. Eng'ing*, Jan. 5.

Changes on Concentration at Electrodes.—T. R. ROSEBRUGH AND W. LASH MILLER.—A long mathematical paper giving the complete theory of the changes of concentration at the electrode brought about by diffusion and by chemical reaction.—*Jour. Phys. Chemistry*, December.

Units, Measurements and Instruments.

Magnetic Testing.—J. G. GRAY AND A. D. ROSS.—An article discussing certain precautions which must be taken in the determination of the magnetic properties of materials. It is well known that the magnetic properties of a test specimen depend on their previous magnetic history. But it is not generally known that purely thermal treatment, such as that involved in the process of annealing a specimen, no matter what temperature is reached in the process, develops in the specimen a peculiar state which renders additional precautions necessary. This is called a "sensitive state" of the material. A magnetization curve yielded by the specimen following upon any change, or cycle of changes, in the temperature is not what may be called the *true* magnetization curve of the material. Fig. 6 shows the results obtained on testing at room temperature by the magnetometric method a specimen of hard steel which had been heated to 900 deg. C. and allowed to cool slowly. Previous to being heated the specimen had been rendered neutral, and during the process of heating and cooling had been exposed to no magnetizing forces. On submitting the specimen in the condition brought about by the thermal treatment described to the action of a magnetizing field which increased gradually from 0 to +9 c.g.s. units, then diminished gradually from +9 c.g.s. units to −9 c.g.s. units, and finally increased in like manner from −9 c.g.s. units to +9 c.g.s. units, the intensity of magnetization followed the curve *O A B C D E*. It will be seen that the point *E* does not coincide with the point *A*, and that the vertical distance of *A* above *O* is much greater than the vertical distance of *C* below *O*. The specimen was now thoroughly demagnetized, and the process repeated, when the curve *O A' B' C' D' E'* was obtained. It is important to notice that the point *E'* coincides with *A'*; the curve is now closed. An inspection of the figure shows that the hysteresis loop is now symmetrical. Cyclic alteration of the magnetizing force between limits $H = \pm 9$ c.g.s. units resulted in the curve being repeated over and over again. *O A'* is the true magnetization curve for the specimen in the annealed condition; it is this curve, and not the curve *O A*, that is characteristic of the magnetic properties of the material. But it is not necessary to anneal at 900 deg. C., since even a moderate alteration in temperature is sufficient to bring about the sensitive state to a marked degree. Once the "sensitive state" has been induced in a specimen it cannot be got rid of except by submitting the specimen to the demagnetizing process. A further series of experiments showed that the "sensitive states" induced by equal augmentations or diminutions of the temperature are of widely different amounts, depending on the position of the temperature ranges on the temperature scale. The effect of these facts on the methods of magnetic testing is pointed out.—*Phil. Mag.*, January.

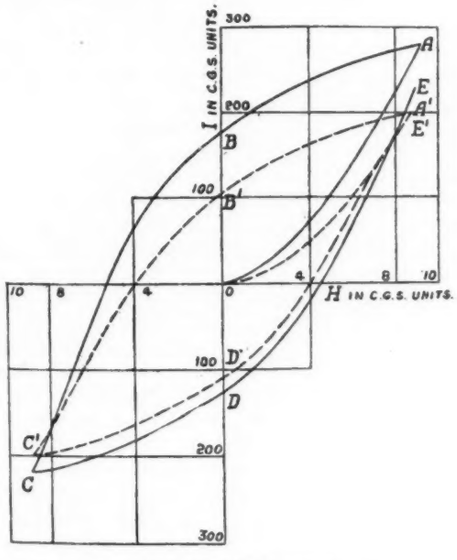


Fig. 6—Magnetization Curves.

Method of Measuring Magnetic Fluxes.—H. ZAHN.—An article criticising some points in the recent paper of Peukert in which it was proposed to measure magnetic fluxes by means of the Hall effect. The present author points out two different sources of error of this method and shows how to overcome them. However, he thinks that the method is inferior to those usually employed.—*Elek. Zeit.*, Dec. 29.

Electrostatic Voltmeter.—G. W. WALKER.—An abstract of a British Royal Society paper on an electrostatic voltmeter for recording the atmospheric potential. The instrument is the result of some experiments made at the Eskdalemuir observatory with the object of obtaining a simple and efficient voltmeter for the continuous photographic registration of the electrical potential at a fixed point in the atmosphere. Experience has shown that occasionally the instrument is required to register up to fully ± 1000 volts. Satisfactory results have been obtained by means of a Dolezalek electrometer. The usual sensitiveness is greatly reduced by using a phosphor-bronze suspension, while the needle is loaded to prevent tilting. A fixed difference of potential is applied between the quadrants by means of one or two standard cadmium cells, while the potential to be measured is applied to the needle. The needle can now carry 1000 volts with perfect safety and stability, while the scale value on the paper is constant to within a few per cent over a range from −900 volts to +900 volts. Trial has been made of a voltmeter (built in the workshop) similar in general design to that of Dolezalek, but in which the fixed difference of potential between the quadrants was provided by making the quadrants alternately of copper and zinc soldered together and not insulated. Uniformity of scale value has been obtained from about −500 volts to +500 volts, but for higher potentials only approximate uniformity is secured. This defect rises from want of mechanical perfection of the quadrants and needle, and should disappear in an instrument made with the same accuracy as that of Dolezalek. At present, also, the damping of the needle during very rapid changes of potential is insufficient. Reference was made to certain points in the manipulation of sulphur for insulating which have been found essential to secure good results.—Lond. *Electrician*, Jan. 6.

Carbondioxide Recorder.—In an article on the recent exhibition of the London Physical Society a description is given of a new CO_2 recorder of a British company. The arrangement is shown in Fig. 7. A sample of the products of combustion is drawn from the flue through the recorder by means of a water aspirator *G* (the inlet of the water from the cistern being at *H*, the outlet of the gas-water to drain at *J*). The gas is first cleaned by being passed through a soot filter *A*, and is then led through a temperature equalizer *C* to the first (*D*)

of two meters *D* and *E*. After passing through this the CO_2 is absorbed in a chamber *F*, the remaining body of gas being measured by the second meter *E*. The two meters are connected by differential gearing to the mechanism driving the recording pen, so that the difference in volume of the gas due to the absorption of the CO_2 is recorded. After a certain definite volume of flue gas has passed through the first meter,

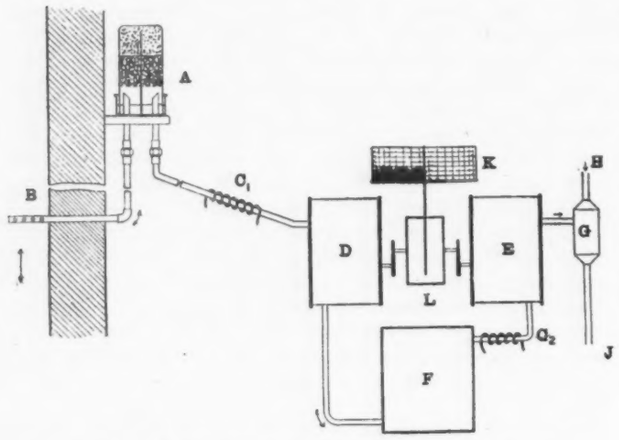


Fig. 7—Diagram Showing Principle of Bi-Meter CO_2 Recorder.

the pen is made to drop to its initial position, from which it again starts to record. To insure that the gas is at the same temperature in passing through the two meters, it is passed through a temperature equalizer before entering each meter. These two equalizers, C_1 and C_2, consist of series of water-cooled pipes. As many as twenty-five analyses can be obtained per hour; the number can be varied by controlling the amount of gas. One of these recorders installed by the Cambridge Electric Supply Company resulted in a saving of forty-nine tons of coal in November last.—Lond. *Electrician*, Jan. 6.

Thermoelectric Pyrometer.—In thermoelectric pyrometry the "cold" end of the couples in the pyrometer head are liable to be subjected to very variable temperatures, introducing errors in the readings. In an article on the recent exhibition of the London Physical Society a description is given of a method of a British company for overcoming this difficulty, employing compensating leads made of copper and copper-nickel alloy and having the same thermo-e.m.f. as the platinum-rhodium couple. These are run in opposition to the couple in

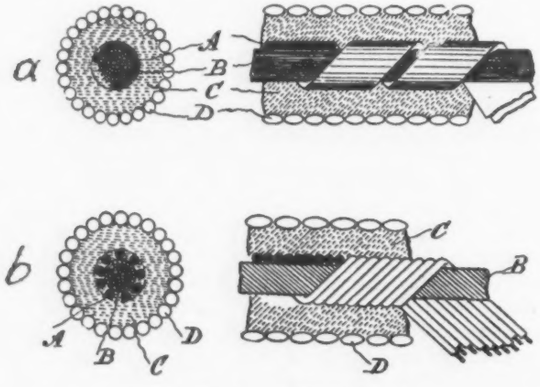


Fig. 8—The Cuntz Electric Cable.

the head of the pyrometer, thus removing the cold junction to the galvanometer and securing a greater accuracy by reason of more constant temperature.—Lond. *Electrician*, Jan. 6.

Electrostatic Alternating-Current Instruments.—R. Ziegenberg.—The conclusion of his long illustrated serial on modern alternating-current instruments. In the present instalment various electrostatic instruments made by German companies are described.—*Zeit. f. Beleucht.*, Dec. 30.

Telegraphy, Telephony and Signals.

Telephone Cable.—A description of a telephone cable devised by Mr. J. H. Cuntz in which capacity is counteracted by uniformly and continuously distributed inductance. The inductance is secured by winding the conductor in the form of a long helix about a supporting core, which in most practical cases would be made of thin iron wires. Two forms of the cable are shown in Fig. 8. In the upper diagrams *a* the conductor *A* is flat or ribbon-shaped so as to be compact and fit closely around the core *B*; while in the lower diagrams *b* the conductor is composed of a number of wires in parallel in order to give greater security against parting of the conductor and to provide a simple and commercially practicable method of manufacture. *C* and *D* in both figures indicate respectively insulation and covering, and sheathing.—*Stevens Indicator*, January.

Wireless Telegraphy.—P. Brenot.—The author describes various new measuring instruments for use in wireless telegraphy, especially for measuring the frequency and for measuring resistances.—*La Lumière Elec.*, Dec. 31.

Coupled Oscillation Circuits.—J. S. Stone.—A mathematical paper on the calculation of the frequencies and damping coefficients of two coupled oscillation circuits.—*La Lumière Elec.*, Dec. 31.

Book Reviews.

Engineering Mathematics. By Charles Proteus Steinmetz, Ph.D. New York: McGraw-Hill Book Company. 297 pages, 93 illus. Price, $3.

In the present work Dr. Steinmetz has given numerous excellent suggestions concerning methods for applying mathematics in engineering problems. Contrary to what one might be led to believe from the title, the book deals to only a limited extent with mathematics as such, but largely with the application to engineering of those branches of mathematics which are best suited for the purpose. A prominent feature of the book resides in the numerical examples taken from engineering problems, almost wholly electrical. Each example given is intended to show not the mathematical significance of the equation involved, but the method by which the engineering problem can be solved. In many cases the solution obtained gives only approximately accurate results, and it is in the treatment of such solutions that the book is most valuable.

The author lays proper stress on the importance of selecting the mathematical tool in accordance with the work to be done; that is, the problem to be solved. He shows, for example, the absurdity of attempting to predetermine within a fraction of 1 per cent the field current of a generator when the exciting currents of generators constructed under the best possible conditions to identical specifications vary by several per cent. It is pointed out that lack of absolute accuracy in engineering calculations does not involve error, but means merely the elimination of refinements that cannot be realized in the engineering equipment. The book affords a happy medium for the instruction of both the mathematician who sees in engineering problems merely possibilities of displaying his ability to create complications out of simplicity and the practising engineer who prefers to guess at the whole result rather than bother with the details by cumbersome mathematical analysis.

The book contains seven chapters and two appendices. The first chapter deals with the "general number," or with strictly numerical determinations; Chapter II is devoted to the potential series and exponential function; the trigonometric series are treated in Chapter III, and maxima and minima in Chapter IV; methods of approximations, empirical curves and numerical calculations occupy Chapters V, VI and VII. The theory of functions and tables of functions are given in the appendices. The subject matter, which formed the basis of a course of lectures to electrical engineering students, is well arranged for use by seniors and juniors in engineering colleges and by others who are already familiar with trigonometry, analytic geometry and calculus.

LEÇONS D'ÉLECTROTECHNIQUE GÉNÉRALE. By P. Janet. Paris: Gauthier-Villars. Vols. 1 and 2. 732 pages, 337 illus. Price, 24 francs.

These volumes constitute a text-book, for colleges and technical schools, on the principles of direct and alternating currents and of the principal types of machinery operating with the same. The theory of the subject is presented to the student briefly in its physical form and is then developed mathematically toward the purpose in view, which is the analysis of the principles and mode of action of the various mechanisms considered. As a text-book the work is one of the best and most nearly complete which have appeared in the French language. It is supported by an unusually full bibliography, to which the reader is referred for the extension, support or collateral treatment of the matters considered in the text. The work is particularly strong on the side of direct-current and alternating-current dynamo machinery and their modes of operation.

HENDRICKS' COMMERCIAL REGISTER OF THE UNITED STATES. Nineteenth annual edition. New York: Samuel E. Hendricks Company. 1342 pages, large 8vo. Price, $10.

The current annual issue of this valuable commercial directory contains over 350,000 names and addresses under more than 35,000 business classifications. The index occupies just 100 pages, or 13 pages more than in the previous edition. The additional pages for the entire volume are 124, and, as 114 pages of matter that appeared the previous year are omitted from this edition, the total gain of pages is 238. A valuable feature of the book is the information accompanying many of the entries stating the specialty of the manufacturer. The electrical industry is well represented, and machinery in general has no less than 2000 classifications. For the purchasing agent of any manufacturing company the book is indispensable, and it is useful to every one who has occasion from time to time to seek the addresses of firms engaged in specific lines of manufacturing.

New Apparatus and Appliances

INSTRUMENT STANDARDIZATION AT THE ENGINEERING DEPARTMENT OF THE NATIONAL ELECTRIC LAMP ASSOCIATION.

In its research and testing work the engineering department of the National Electric Lamp Association requires the use of a large number of electrical instruments which must be calibrated with the greatest possible precision. In the testing section alone there are some 18,000 photometer readings taken every month on lamps which are sent to the association by the member companies to be tested; and, in addition to this, there are made here approximately seventy-five photometric standards a month, which are sent out to the member companies for use in rating their lamps. When one considers that the millions of lamps manufactured each year by these companies are photometered by using photometric standards which are made by the engineering department it will be realized that the accuracy of the instruments used for this work must be of the best.

The calibration-room, from which all of the standardization is carried on, is situated in the basement of the new Engineering building at the corner of Hough Avenue and East Forty-fifth Street, Cleveland, Ohio. In order to minimize the vibrations transmitted from machines in the building a concrete pier, 6 ft. x 12 ft., was sunk into the earth, upon which was placed the table supporting the standard instruments. This table is constructed of solid oak and the top is made of a slab of slate 11½ ft. long, 5½ ft. wide and 2 1/16 in. thick. All of the switching apparatus is connected permanently to this board and the instruments rest directly upon it.

Connecting this table to a plug board there are six pairs of leads by means of which it is possible to connect the standard instruments to any other apparatus throughout the building. From this plug board, which has sixty plug connections, there are nine pairs leading to the "pit" or dynamo-room. The connections are made by means of taper plugs and sockets and any desired form of current may be obtained on the different lines. Through this board alternating current of any practical frequency at 30 volts, 60 volts, 120 volts and 240 volts pressure may be obtained, while almost any desired direct-current voltage and amperage is obtainable from storage cells and from generators.

In addition to the nine pairs of supply leads there are four pairs of leads connected to a test table, four pairs to the photometer-room plug board, four pairs to the plug on the third floor of the building, one pair to the lamp-testing racks, one instrument-checking pair and one pair to two-lamp banks for loading purposes. By means of the leads to the lamp-testing racks it is possible to tell instantly the voltage on the main busbar, and by means of those connecting with the photometer board two or more sets of instruments may be calibrated simultaneously. The checking circuit connects with the photometer-room and the rotating-mirror photometer and has five outlets on the third floor for instruments located there.

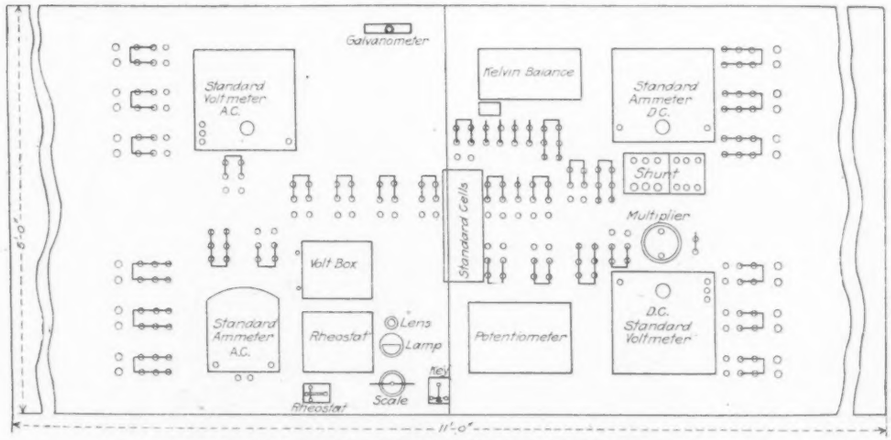


Fig. 1—Arrangement of Testing Apparatus.

The instruments which are used for standards are all of modern and approved type. They consist of a Weston standard direct-current voltmeter with a 15-volt, 75-volt and 150-volt scale and with a multiplier extending the range to 300 volts. For current measurement there is used a Weston standard millivoltmeter with a set of standard shunts which give a range of from zero to 0.5 amp, 2 amp, 5 amp or 20 amp.

For purposes requiring the greatest possible accuracy a Leeds & Northrup potentiometer with a range of from 0 volt to 1.5 volt is used, and by means of an external volt-box ranges of from 15 volts, 150 volts and 1500 volts may be obtained. On a 150-volt range readings may be taken to 0.01 volt and

on the 1.5-volt range to 0.0001 volt. A standard Leeds & Northrup Wheatstone bridge and galvanometer are used for resistance measurements. This set is placed on the standardization table in order to insure accurate results.

Three Weston standard cells are kept in the calibration-room. One of these was checked by the Bureau of Standards, another at the laboratories of the Weston Electric Instrument Company, while the third was tested at the Electrical Testing

Fig. 2—View of Laboratory.

Laboratories. By this means it is possible to insure the greatest reliability for these cells, and it has proved a very satisfactory system. The cells are packed solidly in a box and the terminals are connected to mercury cups, which are sealed when not in use, so that the cells are never in danger of an accidental short-circuit.

For alternating-current work there is a Siemens & Halske standard alternating-current ammeter with a range of from 0 amp to 2.5 amp and 5 amp, and a Weston standard oil-insulated voltmeter, with scales of 150 volts to 300 volts. For current measurements there is a Kelvin balance of 10-amp capacity, which is used to check the potentiometer.

In making the most accurate calibrations temperature measurements are made of the table, the instruments and the room. In checking alternating-current instruments a precision of from 0.2 per cent to 0.5 per cent is obtained, while on direct current a precision of from 0.1 per cent to 0.2 per cent is possible. In addition to the standardizing table there is a testing table on which all heavy work, such as transformer and motor testing, is carried on. During the past few months there have been tested 760 transformers of ¾-kw rating, which are used on the lamp-life testing racks.

An interesting feature of the wiring system is the telephone checking circuit. This telephone circuit is equipped with two switchboard operators' sets which enable two men to communicate with each other while checking instruments in their working positions in different parts of the building. The entire checking system of the building is wired with No. 4 and No. 8 stranded copper, so that the line drop for voltmeter work is negligible.

The main idea which is carried through the work is that of precision. All the instruments used throughout the building are checked every week and calibrated monthly. The laboratory standard instruments are checked weekly against current-checking lamps and at less frequent intervals against the standard photometer. The association appreciates the necessity for the most accurate work possible, and with this in view every facility which will in any way improve this work of standardization is thoroughly investigated.

CLOSING OF CHICAGO ELECTRICAL SHOW.

The Chicago Electrical Show of 1911 closed its doors Saturday evening, Jan. 21, after the most successful two-weeks' exhibition in the history of the Electrical Trades Exposition Company, under whose auspices it, like the preceding five annual expositions, was held. The total attendance during the thirteen days exceeded that of previous years, pleasant weather during the latter week swelling the numbers who thronged the Coliseum and annex. The 1911 show was also notable by reason of the comparatively large amount of business, in both present and prospective orders, reported done by exhibitors from their exhibit booths. A feature of this business was in the better class of sales, electric automobile dealers and manufacturers of the more expensive household devices being especially successful. Friday, Jan. 20, was Wisconsin day, when the members of the Wisconsin Electrical Association in convention at Milwaukee the preceding days visited the Chicago Electrical Show in a body as guests of Manager Homer E. Niesz.

SPEED-CONTROLLING DEVICES FOR SERVICE REQUIRING CONSTANT TORQUE.

For the control of series, shunt or compound-wound direct-current motors driving machinery the nature of whose work is such that a constant torque must be developed by the motor, the controlling device must be of rugged construction. The General Electric speed-controlling rheostats are designed for this

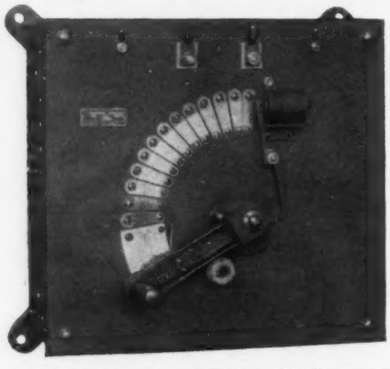


Fig. 1—Rheostat with Renewable Segments.

service and embody features which add to the convenience and reliability of their operation. The contact segments are of liberal size and so designed that they may be very easily and

Fig. 2—Motor-Starting Panel Complete with Rheostat.

quickly removed. For protection from failure of the circuit and the consequent danger of power being again thrown on the line without resistance in series with the motor armature, the rheostats are provided with a no-voltage release attachment. Upon

failure of the circuit, the retaining magnet is demagnetized, releasing the switch arm, and a spring instantly returns it to the "off" position. The no-voltage release coil is connected directly across the line in series with a resistance and is thus independent of the current of the motor field and will protect any motor with which the rheostat may be used. The resistance units are of non-fragile design and thoroughly ventilated. Where additional protection is desired rheostats possessing the features of those just described and in addition an overload release coil are obtainable, and where the service is not so severe the same type of rheostat may be used, minus the renewable segments. In the larger sizes the circuit is made and broken on an easily renewed auxiliary button. The controllers are mounted on a slate base in connection with a double-pole circuit-breaker, presenting a compact and attractive appearance and affording ease of installation.

OIL SWITCH FOR SWITCHBOARD OR WALL MOUNTING.

The switches illustrated herewith are of the vertical upbreak type, a construction which is desirable because of the fact that the maximum depth of oil is secured at the point of rupture of the circuit. The oil tank is made of cast iron and constitutes the main frame of the switch. It has a cast-iron cover which is held in place by hinged bolts and thumb-screws and which holds a felt packing ring tightly in place so that practically no dust can get in or oil escape from the case. The level of the oil in the case is shown by an indicator on the outside, and provision is made for drawing off the oil by means of a drain pipe.

The working parts of the switch, including the stationary and bridging contacts, are made in a unit which is conveniently removable from the tank without disturbing the leads or connections. An inter-lock is provided so that the switch unit cannot be removed from or inserted in the tank unless the contacts are in the "open" position. The contacts are so arranged that a rubbing action takes place when they are brought together, tending to keep them clean and to squeeze out the film of oil between them. Auxiliary removable arcing contacts are provided which break after the main contacts have spread by approximately ¼ in.

When the automatic tripping feature is applied, three tripping coils, for the three-pole automatic switch, are arranged for connection to three series transformers which are furnished with the switch. The two-pole switches are provided with one series transformer and the four-pole switch with two. The tripping mechanism is rugged in construction and at the same time sensitive to over-load conditions and positive in its action. The switches are calibrated for from 80 per cent to 160 per cent of the rated current of the switch.

Fig. 1—Oil Switch Assembled.

The advantageous features claimed for the switch are as follows: The switch unit can be removed and taken to an adjacent bench where an inspection and all necessary adjustments can be made with good light. The switch units of any one size are interchangeable, so that an extra switch unit can be placed in the case while one which has been in operation is removed, if this procedure is desirable. With these oil switches the arc is drawn at a point of greater depth of oil than the usual construction permits. This arrangement avoids the throwing of oil when the switch is open under a heavy over-load or short-circuit and affords a good breaking capacity with minimum disturbance. The tripping coils and automatic features of the switch are entirely inclosed and protected within the case, while at the same time they are easily accessible for inspection.

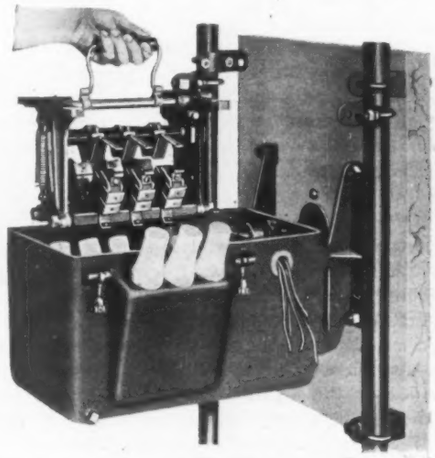
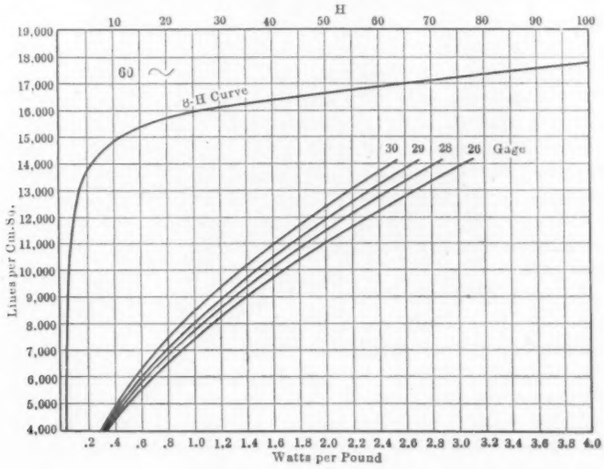


Fig. 2—Oil Switch with Contact Device Removed.

These switches have been placed on the market by the Allis-Chalmers Company for currents up to 300 amp and e.m.f. up to 3300 volts, both with and without automatic tripping devices.

CORE LOSS DATA.

The Follansbee Brothers Company, Follansbee, W. Va., the steel plant of which makes a specialty of sheet metal for electrical purposes, has issued a curve sheet, reproduced herewith, giving core loss data. As will be noted, the sheet is for 60 cycles, and includes a B-H curve and four curves giving the "core loss" for sheets of four different gages.



Magnetization and Core Loss Curves.

A 400,000-VOLT TESTING TRANSFORMER.

The R. Thomas & Sons Company, of East Liverpool, Ohio, has recently installed in its Lisbon (Ohio) insulator manufacturing plant a testing set of large rating to be used for testing transmission line insulators, high-voltage tubes and bushings, etc. The transformer was built by the General Electric Company at Pittsfield, Mass., Mr. J. J. Frank having immediate supervision of the design and construction. It is of 250 kw rating designed for 400,000 volts, 60 cycles. The primary is wound for 2300 volts, and is divided into two coils, the terminals of which are brought to a double-pole, double-throw switch in such a way that they may be connected either in series or in parallel so that with 2300 volts impressed either 200,000 volts or 400,000 volts may be obtained on the secondary.

The transformer may be operated at a much higher voltage than its rating calls for. It was operated continuously for one-half hour at 650,000 volts prior to shipment from Pittsfield.

The middle points of both the high-tension and the low-tension windings are permanently grounded. Provision is made for changing the low-voltage ground connection whenever the coils are changed from series to multiple or vice versa.

The low-tension winding is placed directly on the core and is surrounded by the high-tension winding in the form of a large number of separately insulated circular disk coils. Use is made of a bare conductor wound one turn per layer and placed between the salvaged edge of the intervening insulation. After being taped the coils are impregnated with insulating compound. The arrangement is shown in Fig. 1. The high-tension winding is supported by porcelain insulators, and between the high-tension and low-tension windings are cylinder insulators with flanged ends. The high-tension transformer leads are of the oil-filled type.

The completed transformer is shown in Fig. 2. It has a height to top of leads of 16.8 ft., occupies a floor area of 5.6 ft. x 10 ft. and weighs 20,000 lb. The case contains 2270 gals. of oil. The iron loss of the transformer is 84,000 watts

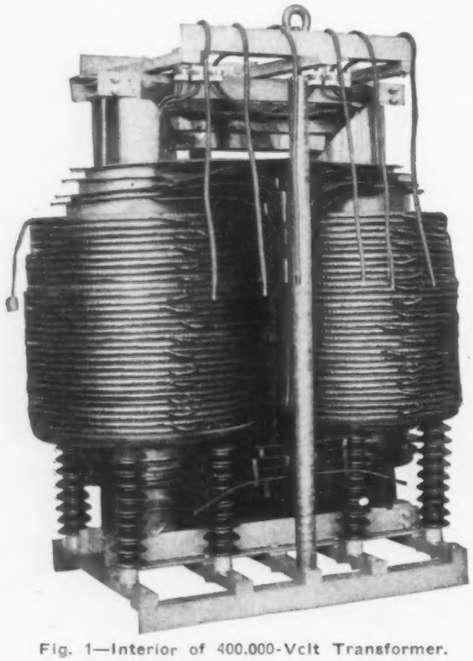


Fig. 1—Interior of 400,000-Volt Transformer.

and the copper loss at full load is 1270 watts, so that the efficiency at an output of 250 kw is 96.3 per cent. The copper loss is only 0.51 per cent. The reactance drop is 5.4 per cent, which is, therefore, practically identical with the impedance percentage of the transformer. The exciting current is equal to 7.18 per cent of the full-load current of the transformer.

In order that this transformer might be supplied with power up to its full rated load, should occasion arise, the R. Thomas & Sons Company has installed a new 250-hp Hamilton Corliss engine. This engine is equipped with an extra-heavy flywheel in order that there might be as little variation in speed as possible when sudden loads were thrown on caused by the breakdown of insulators at high voltages and by arcs over strings of suspension insulators under test. The main engine shaft also carries two belt pulleys, from one of which the factory machinery is driven, the other driving the jack-

Fig. 2—View of Assembled Transformer, Showing Oil-Filled Heads.

shaft to which are belted the generator used for test purposes and the generator for lighting the plant.

The test generator is a Western Electric 200-kw, three-phase, 60-cycle, 2300-volt, 600 r.p.m. star-connected machine running single phase. The exciter is directly connected and is a 250-volt, 7.5-kw machine. The generator room panel and also the control switchboard were supplied with the generator by the Western Electric Company.

The method of controlling the voltage for testing purposes is entirely by the rheostats in the alternator and exciter field circuits.

On the generator panel is mounted a double-pole, single-throw oil switch with series-trip mechanism. There is also mounted on this panel and operated in connection with the oil switch a contact maker for closing a signal circuit connected to a lamp on the control switchboard, which is placed conveniently near both the transformer and the test-room. This lamp indicates the opening and closing of the switch in the generator room. A push button provided on the control board and connected with a bell in the generator room gives signals for starting and stopping the machine.

Mounted on the control board are an alternating-current voltmeter permanently connected through its transformer to the mains and an alterating-current ammeter connected permanently to the mains through a series transformer and supplied with a short-circuiting switch and a direct-current voltmeter connected to the exciter circuit.

For fine and accurate readings there has been provided a portable voltmeter so arranged with a special transformer having taps connected to a high-voltage plug switch mounted in the table of the control board that the voltmeter reading will

be 100 when the generator volts are 515, 1150, 1725 or 2300, depending on the hole in which the switch plug is placed. It will be noted that this arrangement gives a great range of accurate readings. Consequently, for any desired test voltage a good reading may be obtained on one or another of these scales, bearing in mind at the same time that by means of the double-pole, double-throw switch above mentioned the ratio of the transformation may be made either 174 to 1 or 87 to 1.

The 2300-volt mains pass through the control board by means of a double-pole, single-throw oil switch. Two lighting circuits are so arranged in connection with this switch that one circuit of white lamps is closed when the oil switch is open and the other of red lamps is closed when the oil switch is closed. Both of these circuits indicate in the rain test-room and in the commercial test-room. The exciter and alternator field circuit rheostats and the alternator field switch are also mounted on this board. The board is so situated that the operator can observe any tests being conducted in either the rain or the commercial test-room.

The rain test-room is used for all experimental high-voltage testing and is fitted up conveniently to make not only the ordinary rain and dry tests on high-voltage line insulators but also tests on tubes, bushings, wall entrances, roof outlets, etc., and can be fitted to do any kind of high-voltage testing that occasion requires. These various tests cover a range of voltage up to and including 500,000.

NEGATIVE RESISTANCE FOR AMPLIFYING TELEPHONIC CURRENTS.

The use of negative resistance for amplifying or reinforcing telephone currents was first suggested by Béla Gáti in United States Patent No. 684,506, dated Oct. 15, 1901. Mr. Gáti specified a circuit for voice currents containing an arc lamp connected in series with a battery and two induction coils, the negative resistance of the lamp to be utilized to amplify the fluctuations in current thus produced. An increase in the current passing through the arc lamp causes its resistance to fall, thus further increasing the current passing through the circuit. A drop in the current passing through the circuit is likewise intensified, owing to the arc lamp increasing in resistance. The induction coils are connected to the two-line sections and act as input and output coils alternately, according to the direction in which speech is being transmitted over the line.

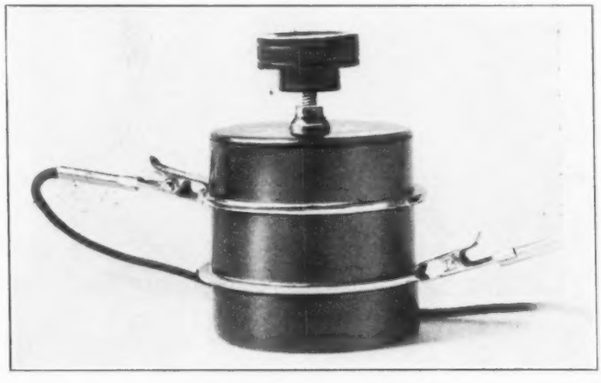


Fig. 1—Telephone Current Amplifyer.

Various modifications of this principle are described in a second patent for a telephone repeater issued to Béla Gáti (No. 799,554) dated Sept. 12, 1905. This basic principle of passing the voice currents through a battery to form direct-current fluctuations and then causing the fluctuations to affect and be amplified by a current-operated variable resistance is further exemplified in a patent issued to Weintraub and Latour (No. 921,930) dated May 18, 1909. This patent refers to the well-known negative resistance character of the mercury-vapor lamp, and particularly relates to means of utilizing the tube at a potential somewhat less than that necessary to maintain an arc, the inventors finding that in this condition it is extraordinarily sensitive to current variations.

A negative resistance telephone repeater is the subject of a

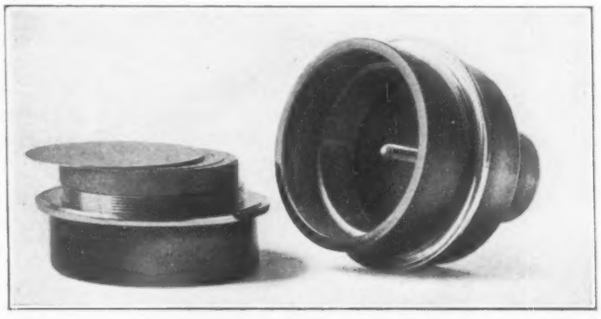


Fig. 2—Interior of Telephone Device.

United States patent (No. 979,012) issued Dec. 20, 1910, to Charles D. Lindridge, 37 Congress Avenue, Providence, R. I. The inventor finds that the sensitiveness of the negative resistance may be increased by bringing its conductance and the potential of current subjected to it within certain critical ranges of adjustment. A silicon-steel contact is mentioned in the specification as an example of negative resistance, and a repeater circuit is described using series-multiple contacts. Various features are incorporated in the patent which, the inventor says, are desirable for use in conjunction with the negative resistance, such, for example, as substitute resistances for use with the series-multiple contacts, adapted to maintain a constant normal potential of current across each contact.

A negative resistance may readily be adjusted so that it automatically maintains a constant potential of current across it when the current passing through it varies within certain limits, but difficulty is experienced in making the potential across it vary inversely with the current passing through it. It is necessary that the potential of current across it vary in this manner, otherwise it cannot amplify current variations. Recent investigations which have been carried on by Mr. Lindridge lead him to believe that this difficulty of adjustment is owing to the resistance of the conducting paths between the electrodes being insufficiently uniform. If any want of uniformity exists in the resistance of these conducting paths current is very readily shunted from the high-resistance paths to the paths of low resistance. This, owing to the negative character of the resistance, has the effect both of increasing the resistance of the high-resistance paths and of making the resistance of the shunt paths drop still further. The result is that an almost inappreciable drop in resistance of one of the conducting paths between the electrodes instantly causes the resistance to break down as a whole and to lose its negative character.

Mr. Lindridge has been led to believe that the requirements of a negative resistance for amplifying current variations are that the resistance of each conducting path between the electrodes be high, that the contact or conducting surface of the electrodes be large and, particularly, that the resistance of all the conducting paths between the electrodes be uniform. This applies to both the contact and the mercury-vapor-tube types of negative resistance. With the idea of providing a negative resistance fulfilling these requirements Mr. Lindridge has recently designed the one of the contact type shown in Figs. 1 and 2. A disk of silicon 2 in. in diameter and ¼ in. thick is supported in a casing and connects with a metal ring extending around the outer edge of the case. This ring is grooved so that a test clip may readily be attached. Immediately above the polished surface of the silicon a steel diaphragm rests, insulated

from the silicon by a thin mica ring. This diaphragm connects with a second metal ring extending around the outer edge of the case. By means of the screw at the top of the case the steel diaphragm may be slightly "crowned" or pressed down to come in contact with the silicon at the center. This idea of crowning a steel diaphragm is utilized in order to prevent the electrodes from bearing against each other with greater or less pressure at the edges on one side than on the other. With the negative resistance shown the greatest pressure between the electrodes is naturally at the center and the least pressure is exerted farthest away from the center, where the electrodes come in contact. But with a very thin insulating mica ring between the electrodes this difference in pressure is inappreciable. Fig. 1 shows the negative resistance complete as it appears when in circuit. Fig. 2 shows the top of the case removed.

AUTOMATIC ELECTRIC TARGETS.

In the accompanying illustration is shown a type of automatic electric target which has been used by the Belgian army for the past three years. The target, which is the invention of Captain Bremer of the Ninth Regiment, shows the marksman the result of his shot on an indicator which is connected by cable to the target proper.

The target proper is made up of a variable number of steel plates, each of which is supported by an iron shank capable of turning around an axis. When a ball hits one of the plates

Automatic Electric Target.

the latter turns toward the rear a sufficient distance to establish contact electrically and then returns to its former position.

The electric indicator is the same in form as the target, the subdivisions of which are reproduced on it. As soon as a ball strikes the target a bell rings and the index of the indicator corresponding to the plate hit appears in sight, so that the marksman can immediately observe which plate has been struck. In comparison with the usual form of target the Bremer arrangement is advantageous in doing away with markers and thereby avoiding the dangers inherent to their employment, in minimizing the time consumed in shooting practice, in rendering the shooting at targets a source of pleasure and instruction, and in reducing the cost of maintaining a shooting range.

At the Brussels national shooting range and at the town ranges of Ostend, Namur, La Louvière and Binche use is made of a so-called annotator which automatically prints the points struck on the target. At the shooting range of Beverloo and Brasschaet large targets with white disks equipped with portable indicators are employed.

One of the most interesting forms of device is the disappearing automatic electric target comprising two silhouette busts placed 10 ft. apart from center to center. In order to bring one of the silhouettes into play it is necessary merely to press one of the two push-buttons with which the indicator near the marksman is equipped. Immediately the silhouette rises, remains in view for a time that may be regulated at will and then disappears automatically.

The above-described targets are being placed on the American market by Emile Maertens, 21 Eddy Street, Providence, R. I.

THE TELEPHONE ON ELECTRIC RAILWAYS.

An excellent example of how an efficient system of communication will quicken train service and aid generally in handling the business of the road is afforded by the New Hampshire Electric Railways on the lines operating around Haverhill, Lawrence, Lowell, Nashua, Hampton Beach, Salisbury Beach and

Fig. 1—Telephone Equipment at Siding.

intermediate points. This railway system uses the telephone in connection with its train dispatching to connect the repair shop with the various car houses, to connect the power house with the rotary stations and for general purposes, such as reporting defects in cars, track and overhead lines and ordering supplies for the various car houses. The telephone system is divided into two general sections corresponding to the divisions of the road, namely, the eastern and western divisions. The eastern division covers about sixty miles of road and is equipped with twenty-eight telephones. The western division is forty-

seven miles in length and is equipped with thirty telephone stations in addition to those in use at Canobie Lake Park. There are also two other telephone circuits, one connecting the car house at Salem with the machine shop and the houses of the master mechanic and superintendent, the other a circuit paralleling the high-tension transmission line which supplies the energy for the road. Electrical energy is generated at Portsmouth, N. H., and transmitted at 13,200 volts, alternating current, to substations at Dover, Stratham, Plaistow, Amesbury, Salem,

Fig. 2—Train Dispatcher at Salem Car House.

Methuen, Pelham and Hampton, where it is converted to 600 volts direct current. The telephone line paralleling the transmission line is fifty-five miles in length and is equipped with telephones at each rotary station. The high-tension patrolman always carries a portable telephone and by cutting into the line can connect with any point desired. The dispatchers at Salem and Amesbury can keep in constant touch with the power house at Portsmouth and each of the rotary stations. In case of a breakdown on the high-tension circuit, if a rotary station gets damaged during heavy storms, the heads of the departments can be notified at once and the necessary steps taken to clear the trouble immediately. The dispatcher for the western division is located at the Salem car house and from this point controls all the cars on this division. The telephone equipment here consists of a switchboard of thirty-line capacity, with trunk lines running to pony switchboards located at Haverhill and the Pelham car houses. At each siding and at other important points along the line there is a telephone booth in which are installed a telephone set, a lightning arrester and a triplicate copying machine. This machine makes three copies of each order, one of which goes to the conductor, another to the motorman, and the third winds up within the machine, which is locked. The switchboards and telephone apparatus of the entire system were furnished by the Western Electric Company.

ELECTRICITY ON A PLANTATION.

On the eastern slope of the Alleghany Mountains in Virginia is located a tract of rolling upland consisting of about 11,000 acres owned by Mr. Thomas F. Ryan, the well-known American financier. The property is at Oak Ridge, Nelson County, on the Southern Railroad between Charlotteville and Lynchburg. Recently this large plantation was equipped with a complete electrical system for lighting all buildings on the place and to supply electric energy to drive the farm machinery, to operate the dairy, the flour and grist mill and to manufacture ice and do the other endless chores pertaining to farm work. Without this modern power system it would require a considerable number of men and horses to do the work about this large plantation. Now the working energy of eighty horses—of 500 men—is confined in one power-room, where it can be instantly dispatched in any amount desired to do the hard work about the farm and the many farm buildings.

The main power house, located near the barn buildings, is of stone construction, with concrete floors, and is amply large enough to house the power-generating machinery and the refrigerating apparatus and leave space enough for the milkrooms

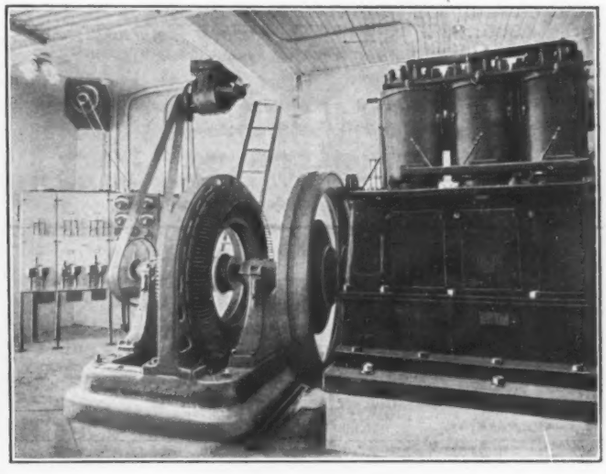


Fig. 1—Interior of Power House, Gas Engine Driving Generator.

and the milk-handling machinery. In the power-room is a 60-kw, three-phase, 2300-volt General Electric generator, direct-connected to a 100-hp, three-cylinder Nash gas engine. The Nash engine operates on gas produced in the building from a gas-producer plant utilizing anthracite pea coal. This gas-driven generator supplies ample current for all the electricity used to light the many buildings on the plantation, gives energy to the many motors driving the farm machinery and provides for the operating of special heating devices, fan motors, etc. Compressed air is used for starting the gas engine, a 1-hp motor operating the air compressor. Fastened to the ceiling in the power-room is a small exciter, belted to the main shaft.

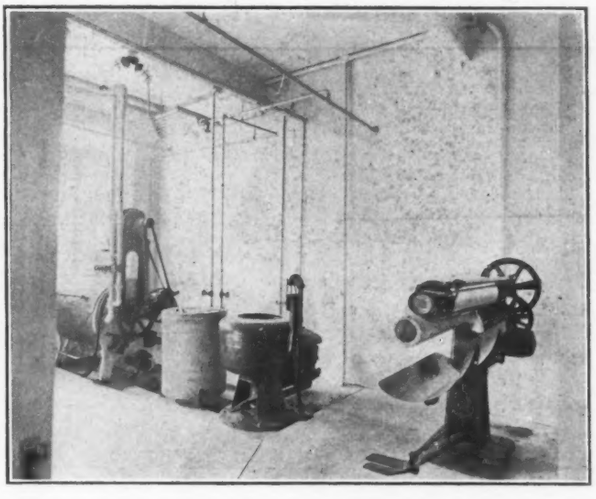


Fig. 2—Laundry.

To the left of the engine and generator are located the necessary switchboard panels. Three 10-kw transformers are placed in the loft of the power house for stepping the voltage down to 220 volts for the motor circuits, with a 110-volt tap for lighting circuits. Standard marine wiring is used throughout and all wires are laid in conduit.

A portion of the power-house building is devoted to refrig-

eration and the manufacture of artificial ice. A ton of ice is made every day, and in addition to this the plant maintains low temperatures in four cold-storage rooms—one for meats, one for the perishable fruit products of the estate, another for milk and still another for milk products, such as cream and butter. A 15-hp General Electric motor drives the ammonia gas compressor in this refrigerating plant, while a smaller motor, of 1½ hp, operates the brine-circulating pump.

Another interesting installation in the power house is a 25-hp low-pressure boiler which generates the steam used for heating the power house, supplies pressure to the small steam turbines which operate the cream separator and the bottle washer and gives a surplus supply of live steam for sterilizing the cans and bottles and the dairy machinery.

The dairy barn, which houses sixty imported Guernsey cows, is a model of its kind, with every convenience for caring for the stock and every sanitary arrangement necessary to preserve the health of the cattle and to assure a large supply of sanitary milk.

The milking is still being done by hand, although a vacuum milking system, driven by an electric motor, is being talked of. The milk is carried on an elevated cableway across the intervening space between the dairy barn and the power-house building and deposited in the milk-receiving vat located in the loft. The milk-handling room is finished in white plaster with a concrete floor. A 3-hp motor drives a countershaft from which are belted the pasteurizers, pump, etc. As the milk descends from the receiving loft by gravity it is strained and cooled. Part is then sterilized or pasteurized for shipment and the remainder is put through a De Laval separator, driven by a tiny steam turbine, the cream being carried away to the ripening room, where it is cured and soured by a special process. In this apartment a 3-hp motor drives the churn and other machinery.

In connection with the milkroom is a washroom where a 2-hp motor drives a countershaft from which is belted a machine for washing cans. This machine washes the can inside and out in one process. A bottle washer is driven by a small steam turbine. Every can, bottle and pail, as well as the parts of

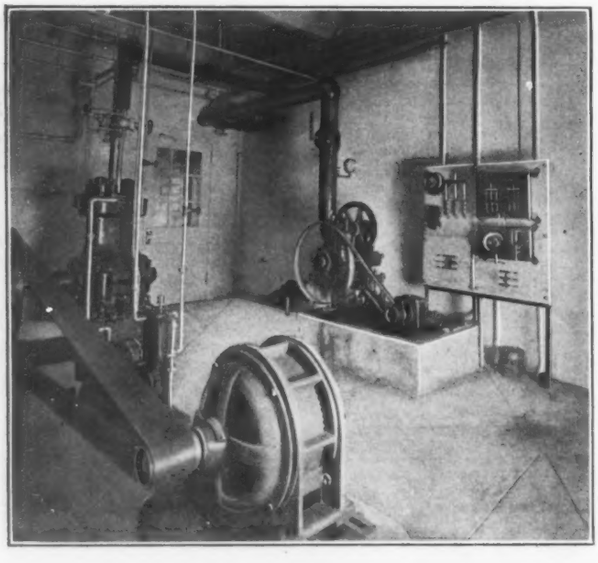


Fig. 3—Refrigerating Apparatus.

the separator and other machinery, are thoroughly sterilized with live steam as soon as the washing is done. Live steam is also used to sterilize the floors and walls of the milkrooms after the rooms have been thoroughly washed and flushed. The dairy attendants are provided with a washroom, which is also equipped with suitable lockers and shower baths.

A novel feature of the dairy work is an up-to-date laundry where the white uniforms and other clothing of the dairymen are laundered. A 2-hp motor drives the washing machine. Another motor, rated at ½ hp, whirls the centrifugal dryer and the mangle is operated by a ½-hp motor. The drum of this mangle is heated by electricity. Electric flatirons are also used.

Besides the blooded cattle on the plantation there are nearly 200 thoroughbred horses. To supply all these animals with ground feed a small flour mill is maintained with a capacity of

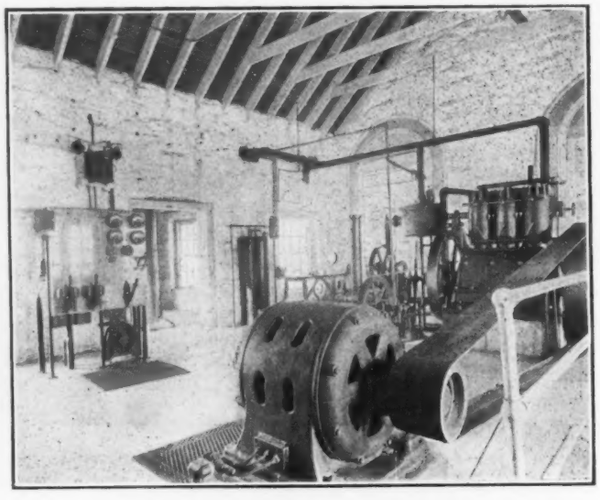


Fig. 4—Auxiliary Power Plant.

50 bbl. of flour a day, where a large portion of the grain produced in that section is made into flour and the waste utilized for cattle feed. This flour mill is driven by a large electric motor.

Electricity plays no insignificant part in adding to the comfort of those who enjoy the hospitality of the Ryan homestead. The energy for lamps for the main residence is furnished by a storage battery located in the basement which is charged from the main power plant. Every room in the large mansion is provided with an abundance of electric light and electricity is also extensively used about the building for heating and other purposes. There are electric dish warmers in the kitchen, electric heaters in the chambers and electric cooking devices for special service.

In order that the electric service need not cease even if the main power plant should meet with some unlooked-for accident, an auxiliary plant is located about 300 yd. from the main power station, which has been arranged for parallel operation with the main plant. In this auxiliary power house, which was the initial electrical equipment on the estate, is located a 50-hp gas-producer plant similar in operation to the one in the main power house. A 45-hp, three-cylinder Nash engine is belted to a 37½-kw alternating-current General Electric generator. This plant, though somewhat smaller, is operated nearly the same as the main plant and is held in readiness to be instantly started up in case of an emergency.

A mile away is still another gas-producer plant where a 37-hp gas engine is direct-connected to a powerful pump which forces water into a large reservoir with a capacity of 365,000 gal. This reservoir is located on a hill, so that the water system for the entire place is operated by gravity, giving an abundant supply of water as well as ample fire protection.

This electrical plant has been in successful operation for nearly a year, and the foreman of Mr. Ryan's plantation speaks in the warmest terms of its conveniences, flexibility and safety. The apparatus was installed by Westerberg & Williams, of New York City, and the electrical equipment is almost entirely General Electric apparatus. Already plans are under way for extensive improvements of the electrical apparatus and ultimately electricity will be employed wherever power is required about the plantation.

Industrial and Commercial News

THE WEEK IN TRADE.

WHILE there has undoubtedly been some increase in commercial business since the first of the year, this increase has not been all that was anticipated, nor have the promises for future business been as bright as were looked for. Jobbers and wholesalers in large commercial centers say that their salesmen are sending in better orders for dry goods, hardware and other staples than were sent in at any period during last fall. Orders, however, are not up to those that were received in the early months of 1910, and indicate that retailers are buying sparingly and with great discrimination. It is evident that the majority of retail merchants prefer to buy frequently rather than to make large orders and lay in heavy stocks. It is known that present stocks in retail hands are very light, but merchants as a rule are willing to let them continue in this state rather than take chances on carrying over a line of unsalable goods. In the industrial world there is no improvement in either woolen or cotton textiles. Mills are running on part time and manufacturing very conservatively. The iron and steel business has been somewhat improved by a definite settlement of the price question. Quite a number of orders have been received, which had been held up until it was positively determined that no reduction in prices would be made. These orders, however, are not as large as had been anticipated. But few new domestic orders have been received for steel rails, although it was reported last week that 25,500 tons had been sold in Argentina and Mexico. All of the plants of the United States Steel Corporation are in operation, although but a few of them are working more than 50 per cent of capacity. Some orders for steel cars were received during the past week, but these were mostly to fill in missing numbers and very few orders for additional equipment were placed. Structural contracts for building work are light. Taking the situation altogether, the West and South seem to be in a much better buying condition than the East. In other words, the agricultural centers are better supplied with money than the industrial centers. Collections continue to be very irregular. In many points they are slow, in the South they are fair, but in no section can they really be rated as good. Business failures for the week ending Jan. 19, as reported by *Bradstreet's*, were 302, as against 353 the previous week, 375 for the same week in 1910, 307 in 1909, 408 in 1908 and 252 in 1907.

THE COPPER MARKET.

DURING the past week the most interesting development in the copper market was the fact that there was a drop in the price of electrolytic by the Amalgamated and United Metal Selling Companies from 13 to 12½ cents, thirty days delivery. For quite a number of months these interests have been holding electrolytic copper at 13 cents, and in spite of independents underselling this price, there have been no considerable sales reported at less than the basic figure. It was apparent that the biggest copper interests in the market had pegged electrolytic at 13 cents, and the fact that they have now been compelled to lower this figure indicates that the copper market is not so strong as some of its advocates are proclaiming. The question as to what constitutes the real surplus supply of copper was brought forcibly to the front last week through a statement in the *Journal of Commerce*. This statement declares that the stocks of copper now on hand amount to 805,000,000 lb. Such a surplus stock is sufficient to create practically a crisis in the copper trade. Among the copper-selling agencies this statement was immediately denied. It was declared that the present stocks are not so great as to invite a crisis, and it was said that the stocks now on hand were approximately about one-half of the figure claimed. A statement from the producers calculated roughly that in the world there was at the present time about 400,000,000 lb. of copper. This absolute conflict of opinion between good authorities makes the copper market such an uncertain quantity that neither speculators nor investors are anxious to buy. There is no question that sales since the first of the year have been light, and although there has been somewhat more activity within the last week than there was previously, the total for the month of January is not at all satisfactory. The melters, who are the great buyers of copper, are not disposed to lay in heavy stocks at the present time. They are only buying to fill immediate needs, and in the present condition of business these immediate needs do not call for large purchases. Exports continue to be fair, but not large. For the month of January, including Jan. 23, exports were 22,905 tons. The imports are running at about the same figure that they have for the last few months. At the daily call on the Metal Exchange Jan. 23, standard copper was quoted as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	12.00	12.10	....
January	12.00	12.10	12.05
February	12.00	12.10	12.05
March	12.00	12.10	12.05
April	12.00	12.10	12.05

The London market Jan. 23 was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	55 7 6	55 7 6
Standard copper, futures	56 5 0	56 5 0

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	12.30c	12.05c
London, spot	£56 15 0	£55 7 6
London, futures	57 12 6	56 2 6
Best selected	60 5 0	59 10 0

INDUSTRIAL AND COMMERCIAL NOTES.

Brooklyn Edison Buys New Equipment.—The Edison Electric Illuminating Company of Brooklyn placed an order last week with the Westinghouse Electric & Manufacturing Company for five 1000-kw, three-phase, 275-volt direct-current rotary converters, equipped with synchronous regulators for varying direct-current work. These regulators run 15 per cent above and 15 per cent below. It also ordered fifteen 400-kw air-blast transformers, 6600-volt frequency changes. The company is in the market for considerable apparatus, including three 2000-kw motor generator sets. There is also to be made a large order for apparatus for induction regulators, switchboards, etc. Orders for the majority of this apparatus, as indicated above, have not yet been placed. When the entire purchases are completed the apparatus will be distributed among the various substations in Brooklyn.

Interest in Storage-Battery Cars.—Since the operation of the Twenty-eighth & Twenty-ninth Street Crosstown Railway by storage-battery cars a very general interest in this system has been awakened in all parts of the country. The Gould Storage Battery Company, which equipped these cars, is in daily receipt of inquiries from small traction companies in all parts of the country, and the prospect is that if the cars prove entirely successful a large number of lines will be equipped with storage batteries. A representative of the Gould company says that, while no large orders have as yet been taken, there seems to be a very heavy business in sight. The storage-battery business is, however, very satisfactory at the present time, although the majority of orders are for small plants and lighting installations.

Electric Tramways and Power Plants in Turkey.—The American embassy at Constantinople furnishes the particulars of an adjudication concerning a concession of electric tramways in the City of Adrianople and the establishment of electric power in the Vilayet of Adrianople; also a concession for electric tramways in the City of Adana and the establishment of electric power in the Vilayet of Adana, which the Minister of Commerce and Public Works has sent to the embassy. These publications can be obtained by application to the Bureau of Manufactures, file No. 6116.

Electric Fan Business.—A representative of the General Electric Company is responsible for the statement that the electric fan business promises to be larger in 1911 than ever before in the history of the industry. Already, he says, orders are being received in such numbers that the fan departments not only of the General Electric Company but of almost all manufacturing concerns are running full time. This heavy demand is unusual at this early season of the year and shows the enormous development in the use of fans in all parts of the country.

Long Acre Electric Light & Power Company.—It has been announced that a syndicate of Boston capitalists, headed by ex-Senator James F. Shaw, has purchased the franchise and property of the Long Acre Light & Power Company. This company now has an application before the Public Service Commission of the First District of New York for permission to issue $10,000,000 in stock and $50,000,000 in bonds. The application was once turned down, and after a hearing in court the Public Service Commission was ordered by the Court of Appeals to reopen the case. The Boston syndicate has been negotiating for the purchase of this franchise and property for some time, and has been represented by Samuel Untermyer, its attorney. Mr. Shaw is an ex-president of the American Street & Interurban Railway Association, and has been connected with traction and lighting propositions since 1893. No definite information concerning the transfer of the property to the Boston syndicate could be obtained at the offices of the Long Acre company, 165 Broadway. Mr. Shaw is quoted as saying: "My syndicate will proceed immediately with the development of electric light and power. The company contemplates the expenditure of at least $10,000,000 in the initial plant. Under the plan proposed our engineers figure that we can sell energy at a lower price to the consumer than is now charged by the New York Edison Company." The Long Acre company was incorporated in April, 1903, for the purpose of manufacturing, distributing and selling energy for light, heat and power. The area of supply as defined in the original certificate of incorporation was bounded by Fifty-ninth Street, Fifth Avenue, Thirty-third Street and the Hudson River in the Borough of Manhattan. This area was extended by an amended certificate in June, 1907, to include all of the Boroughs of Manhattan and the Bronx. The franchise under which it operates was originally granted to the American Electric Manufacturing Company by the Board of Aldermen in May, 1887. This franchise passed through several hands, and finally came into the possession of the Long Acre company. At the hearing before the Public Service Commission early in the present month, attorneys for the New York Edison Company claimed that the franchise under which the Long Acre company proposed to operate had lapsed on account of non-use. This question is still undetermined by the commission and will be taken up at the hearing set for Jan. 31. Mr. Shaw was elected president of the Long Acre company last week.

Western Electric Company's Business.—In the issue of Jan. 12 the *Electrical World* published an estimate, from official sources, that the business of the Western Electric Company for the thirteen months ended Dec. 31 would amount to approximately $66,000,000. It is now officially given out that the gross sales for this period will be about $68,000,000. The difference is accounted for by the abnormally heavy bookings in December. The last month of any big manufacturing company is always swelled by a number of clean-up orders. The Western Electric has recently opened three new branch houses, one in Buffalo, another in Portland, Ore., a third in Milwaukee, giving it twenty-three branch houses in different parts of the United States. At present pay-rolls contain 24,000 names. The company is engaged in important plant developments at its big Hawthorne works which will cost during 1911 close to $1,000,000. This work has all been financed, however, and the company is in the best financial condition of any time in the last five years. In speaking of the outlook for 1911 an official of the company says: "The current year promises well and I am confident we shall show a healthy gain over 1910, but, of course, anything like the $16,000,000, or 35 per cent, increase over the 1909 twelve months cannot reasonably be expected. It would seem fair, however, to expect that gross sales this year will touch the former high record of $69,000,000. Western Electric has been buying its copper in hand-to-mouth quantities and will probably continue to do so for some time."

Additions to Chicago Drainage Canal Power House.—Work is under way for the addition of a seventh 4000-kw generating unit in the hydroelectric station of the Sanitary District on the Chicago Drainage Canal at Lockport, Ill. The turbine waterwheel will be furnished by the Wellman-Seaver-Morgan Company, of Cleveland, and the W. A. Jackson Company, of Chicago, will furnish and install the oil switches. The contract for the generator itself has not been awarded. The same is true in the case of the transformers, but the committee in charge of the matter for the Sanitary District trustees had recommended originally that the transformer order be placed with the Moloney Electric Company, of St. Louis, although later the matter of awarding the transformer contract was postponed. There will be six transformers, each rated at 1333 kw. Three of these will be step-up transformers placed in the power house, wound for 6600 volts on the primary side and 44,000 volts on the secondary side. In the Western Avenue terminal station in Chicago there will be three step-down transformers, reducing the voltage from the transmission-line potential to 12,000, 9000 or 6600 volts, according to the connections used on the secondary side.

New York Telephone Company.—A definite offer has been submitted to the Board of Estimate of New York City by the New York Telephone Company under which it proposes to increase its annual franchise fee for the exclusive right to provide telephone service. This offer is to take the place of one made in 1906. The company offers to pay $122,000 per year during the first period of five years, $134,000 during the second period, $152,000 during the third period, $176,000 during the fourth period and $200,000 thereafter. Under the original offer the company agreed to furnish service for the city's own use at 50 per cent reduction from schedule rates. It now claims that it cannot do more than continue to furnish such service at 25 per cent reduction. The company also revokes its offer to adjust its rates so as to limit its net earnings to approximately 10 per cent, "as jurisdiction over these matters has since been placed in the hands of the Public Service Commission of the Second District."

Allis-Chalmers Selling Abroad.—While the foreign sales of the Allis-Chalmers Company during the past few months have not been up to the high standard set last year they still have been very good. Japan is buying more freely than any other country and several large orders have recently been taken from that country. One of the most important of these is a steam and electric flour mill of 500-barrel-per-day capacity which the Allis-Chalmers Company, through the American Trading Company, has furnished complete. This installation includes a generating plant and individual motors for the entire mill. Another large order which the Allis-Chalmers Company has recently taken is for the Taihaku Sugar Company on the island of Formosa. This mill will install a 500-kw reciprocating engine-driven generator set with individual motors throughout. It will be one of the largest sugar mills in the world, turning out 700 tons per day. The output will be sold mainly in Japan and Manchuria.

Illinois Traction Association.—Plans are under way for the organization of the electric railways of the State of Illinois into an association for the purpose of presenting a united front in the competition for business with the steam roads. A preliminary organization has been formed under the name of the Illinois Electric Railway Association. The prospectus of this organization announces that it is proposed to connect all interurban lines in Illinois eventually, to fix uniform rates, to issue uniform interchangeable mileage books, to make a concerted combination for freight traffic and to improve the interurban service throughout the entire State by the adoption of standard equipment.

Syracuse Railway Consolidation.—The control of the Buffalo, Lockport & Rochester Electric Railroad Company has been formally taken over by the Beebe Electric Railway interests of Syracuse. The fact that a syndicate represented by C. D. Beebe had purchased the railroad was published in our issue of Dec. 22, 1910. Last week new officers were elected for the Buffalo, Lockport & Rochester Company as follows: President, C. D. Beebe, of Syracuse; first vice-president and general manager, J. M. Campbell, of Rochester; second vice-president, F. A. Dudley, of Buffalo; secretary and treasurer, H. C. Beatty, of Syracuse.

Moore Light-Western Electric Company.—An arrangement has been made between the Moore Light Company, of Newark, and the Western Electric Company whereby the latter will act as sales agent for the former. This arrangement is similar to that existing between the Western Electric Company and the Beck Lamp Company. There is no question of ownership or control, the larger company simply acting as sales agent in pushing the product of the Moore Light Company.

Telephone Building in Buffalo.—It is reported that negotiations are under way by the New York Telephone Company for the purchase of a site at the corner of Church and Franklin Streets, in Buffalo, on which the company purposes to erect a twenty-story building to be used partly as the headquarters of its Buffalo exchange system.

Wireless in Alaska.—The southern coast of Alaska will be brought into closer touch with the outside world by two additional wireless stations which the Navy Department will soon establish on the southern coast. These stations will be located in Unalaska, one of the Aleutian Islands, and at Kodiak, which is at the southern end of the Alaska peninsula. The United States Navy Department already maintains wireless stations in Alaska at Sitka and Cordova, and the army maintains stations at Nome and St. Michaels. These two new stations, while they belong to the Navy Department, will be open to commercial business on all ordinary occasions. It is said that if the stations work satisfactorily there will be an effort made in the spring to open communication between them and the Hawaiian Islands.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Independence, Ia.; La Salle, Ill.; Atlanta, Ga.; Leavenworth, Kan.; Glen Ellyn, Ill.; Troy, Ala.; Yale, Mich.; Grand Island, Neb.; Boone, Ia.; Mammoth Springs, Ark.; Virginia, Ill.; Canton, Pa.; Durand, Mich.; Tipton, Ind.; Elsinore, Cal.; College Park, Ga.; Fort Worth, Tex.; Needles Cal.; Tacoma, Wash.; Toronto, Ont., Can.; Wheeling, W. Va.; Memphis, Tenn.; Knightstown, Ind.; Madisonville, Ohio; Ellicott City, Md.; South Fork, Pa.; Mount Olive, Ill., and London, Ont., Can.

Financial.

THE WEEK IN WALL STREET.

SPECULATORS who have been working for higher prices in Wall street made some little headway last week. Although there was no evidence that there was any buying from outside, there was stimulated among the professionals quite an active buying interest, which was especially developed only on the soft spots. This sort of activity does not mean much, except that professional traders are in some measure beginning to be convinced that the market will eventually become active and that prices will be higher. This class of traders only buys with a view to selling at better figures, and it is always an encouraging feature when the professional trader, who is the smartest dealer in the market, believes that prices will go higher. During the past week there were several matters which came to the front indicating a better situation in Wall Street. The improved foreign trade statement helped matters along, as the foreign trade statement is always considered an index to the general prosperity of the country. The Aldrich plan for remodeling our currency and banking system was favorably received by the Street. This also had something to do with encouraging those who make a business of trading on the Stock Exchange. Then, again, the bank statements showed that there had been a remarkable accumulation of funds in the local banks. These statements were not sufficient in themselves to create any great amount of enthusiasm, but when taken in connection with the fact that several large bond issues were offered during the week, and were readily absorbed, they seemed to indicate that the money situation is entirely satisfactory. As a matter of fact, the lack of speculation in Wall Street for many months past has not been due to any difficulty in acquiring money. Reports from the iron and steel trade were not particularly encouraging, but they indicated that the majority of mills were operating at about 50 per cent of capacity. Sales were not heavy, but expenses were, as a rule, trimmed to meet the volume of business, and there is no reason to believe that the United States Steel Corporation will fail to earn considerably more in each quarter than its dividend requirements. Several good bond issues were absorbed during the week, showing that while investors are very timid about getting into the stock market, they are not unwilling to take hold of good bonds when offered at reasonable prices. The money market during the week was extremely easy. As a rule rates for call loans were less than 2¾ per cent. Quotations Jan. 23 were: Call, 2½@2¾ per cent; 90 days, 3¼@3½ per cent. The quotations in the table are those of the close Jan. 23:

NEW YORK.

	Jan. 16.	Jan. 23.	Shares Sold.		Jan. 16.	Jan. 23.	Shares Sold.
All. Ch.....	8	8*	1,100	Int. Met., pfd.	53⅜	51¼	6,950
All. Ch., pfd.	28*	29	———	Mackay Cos.	92⅞*	92½*	600
Amal. Cop...	63½	63⅝	74,120	Mackay C., pf	75⅞	75¼	420
Am. D. T...	20½*	20½*	———	Man. Elev...	140*	138	295
Am. Loco...	40	40⅛*	3,900	Met. St. Ry.	15*	15*	———
Am. Loco.,pf.	110	110⅜	200	N.Y.&N.J.Tel.	139¼*	139¼*	———
Am. Tel. & C.	85	83½*	610	Steel, com..	76	77⅛	484,600
Am. T. & T..	142¼	143½	22,983	Steel, pfd....	118¾*	119	9,174
B. R. T.....	77⅛	76⅝	28,620	W. U. T....	74¼	74½	17,160
Gen. Elec....	151*	151½	1,400	West'h, com.	67*	67	1,900
Int. Met....	19⅛	18¾	4,500	West'h, pfd..	116*	119*	100

PHILADELPHIA.

	Jan. 16.	Jan. 23.		Jan. 16.	Jan. 23.
Am. Rys.....	43½	45	Phila. Elec.....	16⅜	16⅛
Elec. Co. of A.....	12½*	12⅛	Phila. R. T.....	19⅞	20¼
Elec. St. B'ty.....	50½	53	Phila. Trac.....	85	86½
E. S. B'ty., pfd.....	30*	30*	Union Trac.....	46⅛	47¾

CHICAGO.

	Jan. 16.	Jan. 23.		Jan. 16.	Jan. 23.
Chi. City Ry.....	185*	185*	Chi. Tel. Co.....	120*	118
Chi. Rs., Ser. 1.....	92½*	93	Met. El. Co.....	22*	21
Chi. Rs., Ser. 2....	23½*	25	Met. El., pfd.....	68	67½*
Com. Edison.....	113½*	113	Nat'l Car.....	117*	117*
Chi. Subways.....	4¼*	4⅛	Nat'l Car., pfd.....	117½*	118*

BOSTON.

	Jan. 16.	Jan. 23.		Jan. 16.	Jan. 23.
Am. T. & T.....	142¼	143⅝	Mex. Tel.....	6*	6*
Cum. Tel.....	147*	146½*	Mex. Tel., pfd.....	6*	6*
Edison E., Ill.....	290	288	N. E. Tel.....	137½	138⅛
Gen. Elec.....	151	151	W. T. & T.....	17*	18½
Mass. E. Ry.....	18*	18	W. T. & T., pfd....	91½*	89
Mass. E. Ry., pfd...	84⅛	85½			

*Last price quoted.
Shares sold for five days, Jan. 16 to Jan. 21.

FINANCIAL NOTES.

Chicago Suburban Light & Power Company.—The Chicago Suburban Light & Power Company, operating in Oak Park and Auburn, western suburbs of Chicago, was acquired recently by interests friendly to the North Shore Electric Company of Chicago. An issue of $2,000,000 of 5½ per cent five-year gold debentures of the Chicago Suburban Light & Power Company, the principal and interest guaranteed by the North Shore Electric Company, is now offered for sale. The entire isue of the company's first-mortgage twenty-year 5 per cent bonds, $2,500,000 in amount, is pledged with the Illinois Trust & Savings Bank of Chicago as collateral security for these debentures. The company will be managed in close harmony with the North Shore Company and the Commonwealth Edison Company, and it is said that the net income available for interest charges on the debentures is three times the requirements. The bonds are offered at 98, yielding nearly 6 per cent.

National Carbon and Two Stock Exchanges.—Chicago newspapers report that the shares of the National Carbon Company have been stricken from the unlisted department of the Chicago Stock Exchange. This action was taken, it is said, because of the failure of the officers of the company to notify the Exchange of an extra dividend of 15 per cent declared on the common stock on Oct. 28 last. It is said that the books of the company were closed at 1 p. m. on the date mentioned without any notification to the Northern Trust Company of Chicago, the transfer agent of the National Carbon Company, or to the Chicago Stock Exchange as to the reason for ordering the books closed. It is also asserted that a similar indifference to the Boston Stock Exchange, where the shares are traded, was exhibited by the company.

Westchester Lighting Company.—The Public Service Commission of the Second District of New York has authorized the Westchester Lighting Company to issue under its first mortgage bonds dated Dec. 1, 1900, an additional amount totaling $2,824,000. The proceeds of these bonds, which are to be sold at par, will be used to discharge the remaining bonded debts of the New York Suburban Gas Company, amounting to $343,000—this company having been merged into the Westchester Lighting Company—and to pay off the floating indebtedness that is now due a number of small creditors. It is claimed that the business of the company during the past year has been very satisfactory, and that by the end of 1911 all floating indebtedness will be liquidated.

Pennsylvania Electric Railway Merger.—Negotiations have about been perfected for the consolidation of trolley and power properties in the neighborhood of Lancaster, Pa. This consolidation has been brought about by a syndicate of Philadelphia capitalists. The properties to be merged are the Lancaster & York Furnace Street Railway, Lancaster & South Side Railway and the Coleman Water & Power Company. A traffic agreement has also been made with the Conestoga Traction Company.

Dover (N. J.) Electric Light Company.—The Public Utilities Commission of New Jersey has granted permission for the consolidation of the Dover Electric Light Company with the Rockaway Electric Light & Improvement Company. The Dover company has controlled the smaller company for some time and now the two are to be merged, the combined company to be known as the Dover Electric Light Company.

New Subway Bids Submitted.—The Bradley Contracting Company has made a formal offer to the Public Service Commission of the First District to construct the main lines laid out under what is known as the Triborough system, and also to equip and operate these lines after they have been completed. The new bid of the Bradley company is the sum total of the lowest bids received by the Public Service Commission for the construction of this work when bids were received in October, 1910. The Bradley company's bid has not as yet been considered technically by the commission, but the fact that such a bid has been received has caused a halt in the consideration of the Interborough's offer, which was made some weeks ago.

Consolidated Gas Company.—The annual report of the Consolidated Gas Company, of New York, which was made public Jan. 23, shows that the total net earnings of the company for 1910 were $3,046,448, which compares with $2,749,568 in the previous year. The total net income of the company from all sources amounted to $7,851,446. The interest charges were $434,967, leaving a surplus for dividends of $7,416,479. This amount is equal to about 7.43 per cent on the capital stock and is taken as a positive indication that the company can earn a fair dividend on its stock with gas at the 80-cent rate. For this reason it is practically certain that the gas company will carry no further the opposition, in the courts, to the 80-cent rate.

Chester Valley Electric Company.—Application has been made at Harrisburg, Pa., for a charter for the Chester Valley Electric Company by a group of Philadelphia and New York capitalists who have acquired a number of electric light and power plants in Chester County, Pa., and who intend to extend their holdings. The capital will ultimately be $1,000,000, and there will be a bond issue of $750,000. The proceeds of the bonds will be used for defraying the cost of constructing a larger power plant on Brandywine Creek near Coatesville. The officers of the company are: President, A. B. Beadle, of New York; secretary and treasurer, W. W. Levering, of Philadelphia.

Public Utility Bonds Offered.—Among the important offerings of bonds last week were: An issue of $2,721,000 consolidated and refunding mortgage 5 per cent bonds of the Seattle Electric Company by Harris, Forbes & Company, of New York, and Lee, Higginson & Company, of Boston, at 98½; $1,653,000 5 per cent first mortgage bonds by Clark, Dodge & Company, New York, and E. W. Clark & Company, Philadelphia, at 95. William A. Read & Company, of Chicago, has advertised an issue of the Boston & Northern Street Railway Company 4 per cent first mortgage bonds at 92¾. The subscription for all of these bonds has been fairly satisfactory.

Lincoln Gas & Electric Company.—The earnings of the Lincoln (Neb.) Gas & Electric Company for 1910 showed a very satisfactory gain over those of the previous year. The gross amounted to $390,185, as compared with $363,589 in 1909. The net earnings were $133,611, an increase of about $5,000. The surplus increased about the same amount. This company has a perpetual franchise for the supply of gas and electricity. It has over 65 miles of mains, 7000 gas meters and 1900 electric meters. The annual output of energy is about 3,150,000 kw. The property is operated by the Doherty Operating Company.

American Telephone & Telegraph Bonds.—It is said that all of the $10,000,000 of American Telephone & Telegraph Company 4 per cent collateral trust bonds which were recently offered for sale by N. W. Harris & Co. have been disposed of. There are still a good many of the bonds in Wall Street, and the supply is not likely to run short for some time. The original syndicate, however, is out from under the market. Quite a large number of these bonds went abroad.

Mohawk Hydroelectric Company.—Pingree, McKinney & Company, of Boston, have purchased $500,000 first mortgage 6 per cent bonds of the Mohawk Hydroelectric Company, of Ephratah, N. Y. These bonds are a part of an authorized issue of $932,000 and run for thirty years. The company will supply energy for light and power to the local companies in Johnstown and Gloversville, N. Y. William Barclay Parsons, of New York, is president of the company.

Westinghouse Machine Company.—The plan adopted some weeks ago by the creditors' committee of the Westinghouse Machine Company and submitted to the noteholders by circular letter has been approved and the consents of 95 per cent of the outstanding creditors have been received. This financial plan was outlined in our issue of Dec. 8, but the proposed mortgage has not yet been authorized by the stockholders.

Triumph Electric Company.—Directors of the Triumph Electric Company, of Cincinnati, have declared a dividend of 1½ per cent on preferred stock for the past quarter, which was paid Jan. 16. The officers report an improvement since the first of the year, with numerous inquiries for machinery. The ice machine branch is also receiving many inquiries with prospects for a good business.

Philadelphia Company Financing.—A special meeting of the stockholders of the Philadelphia Company, of Pittsburg, has been called for April 4 to vote on the proposed increase in the capital stock of the company by $1,400,000. The proceeds of this increase in stock will be used for the purpose of exchanging convertible notes aggregating $1,400,000 which are now outstanding.

Montreal Light, Heat & Power Company.—It has been announced that the Montreal Light, Heat & Power Company, instead of increasing its dividend from 7 to 8 per cent, has during the past few months granted concessions to consumers amounting in value to over $350,000 a year. This would amount to little more than 2 per cent on the company's capital stock.

DIVIDENDS.

Cambridge (Mass.) Electric Light Company, quarterly, 2½ per cent, payable Feb. 1.

Cincinnati Northern Traction Company, annual, 3 per cent, payable March 1.

Cities Service Company, monthly, preferred, ½ per cent; common, ¼ per cent, both payable Feb. 1.

Commonwealth Edison Company, quarterly, 1½ per cent, payable Feb. 1.

East St. Louis & Suburban Company, preferred, quarterly, 1¼ per cent, payable Feb. 1.

Edison Electric Illuminating Company of Boston, quarterly, $3 per share, payable Feb. 1.

Jacksonville (Fla.) Electric Company, semi-annual, 3½ per cent, payable Feb. 1.

Kellogg Switchboard Company, quarterly, 2 per cent, payable Feb. 1.

Lowell (Mass.) Electric Light Corporation, quarterly, $2 per share, payable Feb. 1.

McCrum-Howell Company, preferred, quarterly, 1¾ per cent, payable Feb. 1.

Metropolitan West Side Elevated Railroad Company, Chicago, quarterly, ¾ per cent, payable March 1.

Michigan State Telephone Company, quarterly, 1¾ per cent, payable March 1.

Montreal Light, Heat & Power Company, quarterly, 2 per cent, payable Feb. 15.

North American Company, quarterly, 1¼ per cent, payable April 1.

Omaha Electric Light & Power Company, preferred, semi-annual, 2½ per cent, payable Feb. 1.

Pacific Gas & Electric Company, preferred, quarterly, 1½ per cent, payable Feb. 15.

Pacific Power & Light Company, preferred, quarterly, 1¾ per cent, payable Feb. 1.

Washington Water Power Company, quarterly, 2 per cent, payable April. 1.

Western Telephone & Telegraph Company, preferred, semi-annual, 2½ per cent, payable Feb. 1.

REPORTS OF EARNINGS.

ELECTRICAL SECURITIES CORPORATION.

Period.			Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
1 yr.,	Dec.	'10	$390,084	$196,854	$193,230	.....	.....
1 "	Oct.	'09	368,501	217,600	150,901	.....	.....
KANSAS CITY RAILWAY & LIGHT COMPANY.							
1m.,	Dec.	'10	$684,385	$417,682	$266,703	$191,069	$75,633
1 "	"	'09	622,049	377,571	244,478	172,062	72,416
7 "	"	'10	4,513,590	2,701,178	1,812,412	1,323,245	489,167
7 "	"	'09	4,173,690	2,396,205	1,777,492	1,209,122	568,370
MONTREAL STREET RAILWAY COMPANY.							
1m.,	Dec.	'10	$377,274	$235,209	$142,065	$37,642	$104,423
1 "	"	'09	337,563	212,006	125,556	34,480	91,076
3 "	"	'10	1,130,060	668,041	461,659	101,635	360,006
3 "	"	'09	1,026,441	586,879	439,562	96,345	343,217
NORTHERN OHIO TRACTION & LIGHT COMPANY.							
1 yr.,	Dec.	'10	$2,437,426	$1,348,963	$1,088,463	$521,069	$567,394
1 "	"	'09	2,117,641	1,190,057	987,584	524,065	463,519

General News

Construction News.

FLORENCE, ALA.—The Muscle Shoals Hydro-Electric Power Company is endeavoring to complete arrangements for its hydroelectric development. The present plans include the construction of three dams to create thirty miles of slack-water navigation, superseding the present narrow and tortuous canal of nine locks. It is proposed to build three locks, each with a lift of 25 ft., to provide navigation over the shoals and make power available. The cost of widening and deepening the present canal is estimated at $7,400,000; the cost of the three dams is estimated at $12,000,000. Congress has been asked to appropriate $9,000,000; the power company proposes to expend $3,000,000 on the three dams and an additional $10,000,000 for construction and maintenance of power plants. The officers of the company are: Frank Washburn, president; J. W. Worthington, vice-president, and W. H. Lindsey, secretary. The offices of the company are at Montgomery, Ala.

TROY, ALA.—Plans are being considered for enlarging the electric light and water plant, which will include the installation of a 150-hp boiler, one 250-kw, 3-phase, 60-cycle generator, direct-connected to steam unit; one electrically driven pump, having a capacity of 2500 gal. per hour. A. B. Campbell is superintendent.

MAMMOTH SPRINGS, ARK.—The Mammoth Springs Electric Company is contemplating the installation of a 1000-kw generator and erecting twenty-eight miles of high-tension transmission lines, carrying 33,000 volts. Preparations are being made by the company to furnish electricity for lamps and motors in five towns. E. C. Bellamy is secretary and manager.

ALAMEDA, CAL.—Electricity for operating the drawbridges across the tidal canal at Park and High Streets and at Fruitvale Avenue will be furnished by the municipal electric light plant. Funds have been provided for the erection of a transmission line from the power house to the bridges, which will cost about $5,000.

ALHAMBRA, CAL.—The Pacific Light & Power Corporation has been awarded the contract for installing and maintaining 350 tungsten street lamps in Alhambra for a term of five years.

CASSEL, CAL.—J. A. Whitehead and C. Whitehead have purchased a site on Hot Creek in Cassel, on which it is understood that a power plant will be erected.

ELSINORE, CAL.—The Consolidated Reservoir & Power Company is pushing development work in the mountains northeast of Banning on streams tributary to the Whitewater River, and it is expected that the company will be able to supply electricity to the ranchers in the Moreno and Perris Valleys within a couple of months. It is probable that the transmission line will be first extended to Moreno and thence to the Perris Valley and on to Elsinore, where the company is interested in a power project. The company, it is said, will erect a number of power houses at various elevations in the canyon.

GERMANTOWN, CAL.—An irrigation system is being developed by Charles D. Shaw in Germantown, embracing 640 acres, work on which is already under way. The pumping plants will be operated by electricity.

GREENVILLE, CAL.—A. R. Bidwell has decided to transfer the Greenville water-works system to the Round Valley Corporation and to float a bond issue, to secure funds for the development of this body of water for power and irrigation purposes. It is estimated that 1000 hp can be developed. It is said that a bond issue of from $100,000 to $200,000 will be placed on the market.

LOS ANGELES, CAL.—A resolution has been submitted to the City Council requesting that it will submit the proposition at the election to be held March 6 as to whether the city shall distribute electricity generated by the Owen River aqueduct for lighting the city and to private consumers or dispose of all or part of it to private corporations for distribution.

LOS ANGELES, CAL.—Sealed proposals will be received at the office of the United States Reclamation Service, Los Angeles, Cal., until Feb. 15 for furnishing centrifugal pumps for the Salt River project in Arizona. Proposals will also be received at the same time and place for motors, transformers and switchboards for centrifugal pumps for the Salt River project. For particulars address United States Reclamation Service, Los Angeles, Cal.; Phœnix, Ariz., or Washington, D. C. F. H. Newell is director.

LONG BEACH, CAL.—Permits have been granted to the Southern California Edison Company for the erection of three buildings in connection with its new power plant in Long Beach, at a cost of $155,000.

NEEDLES, CAL.—The plant and holdings of the Needles Light & Power Company have been purchased by E. H. Rose, of Los Angeles, Cal., who, it is said, will enlarge and improve the plant. It is proposed to duplicate the equipment of the present plant and to operate the gas plant in connection with the electric plant.

SANTA BARBARA, CAL.—Initial steps have been taken for the installation of ornamental cluster lamps in the business district of the town. It is expected that the property owners will install lamps and standards and that the system will be extended in the near future.

SELMA, CAL.—The Fowler Independent Telephone Company has increased its capital stock from $7,500 to $30,000.

WILLOWS, CAL.—The Town Trustees have refused to accept the bid of the Northern California Power Company to furnish arc lamps for lighting the streets of the town at the rate of $72 each per year, under a five-year contract. As a new company will be operating in Willows within four months, it is thought that a lower rate can be obtained. The residents living in the outlying districts are making urgent demands for street lamps.

WILLOWS, CAL.—The Superior California Power Company has awarded the contract for the erection of its transmission line from a point some distance above Orland to Willows and beyond to the Sierra Construction Company, work on which will begin at once. Two transmission lines will be erected by the Superior California Company, each about thirty miles long, one extending from Orland to Willows and the other along the river. There will be about 100 miles of main and lateral lines, which will supply electricity to the towns and farms along the route for lamps and motors and also for operating pumps for irrigating purposes. Electricity for operating the system will be taken from the main lines of the Northern California Power Company. C. R. Wickes, of Willows, who has secured the franchises for the lines, is at the head of the Superior California Power Company.

ERIE, COL.—Plans are being considered for enlarging the municipal electric-light plant about May 1, 1911. The equipment will consist of a new boiler, larger generator and installation of a heating plant. H. O. Barraclough.

GROTON, CONN.—Plans are being considered to increase the output of the municipal electric light plant during the coming year. T. A. Graves is superintendent.

JEWETT CITY, CONN.—The municipal electric light plant was closed down Dec. 1, 1910, and the equipment is to be sold. Electricity for operating the municipal electric system is now supplied by the Nashawaug Electric Power Company's plant at Plainfield, Conn. The office of the company is located at Danielson, Conn.

NEW HAVEN, CONN.—Application will be made to the State Legislature by the New York, New Haven & Hartford Railroad Company for permission to build an electric railway from New Hartford, Conn., to New Boston, Mass., through the Farmington Valley. It is said that the route will probably follow the old Lee and New Haven railroad.

PLAINVILLE, CONN.—Plans have been prepared by the Trumbull Electric Manufacturing Company, of Plainville, Conn., for extensive additions to its manufacturing plant, which will include the erection of several buildings, including a boiler house and engine house, the installation of sprinkler system and electric system. The power equipment, it is understood, has been purchased.

WATERBURY, CONN.—The Board of Aldermen has passed an ordinance in favor of the construction of an electric light plant.

MILTON, DEL.—The Ingram Mill property is reported to have been purchased by a syndicate which is headed by N. W. White, of Georgetown, Del. It is said that the new owners propose to erect an electric plant to furnish electricity for lamps and motors in the town of Milton.

DADE CITY, FLA.—The Dade City Ice, Light & Power Company has recently installed a series tungsten street lighting system and is contemplating establishing a day service. The company is also considering changing its system from single-phase, 133-cycle to three-phase, 60-cycle during the year. Emil W. Muller is president and manager.

MARIANNA, FLA.—The consolidation of the municipal electric-light and water plants, at a cost of nearly $10,000, is nearly completed. It is proposed to replace the present engine with a large one if a suitable second-hand 120-hp, high-speed engine can be obtained. George C. Spencer is superintendent.

ST. AUGUSTINE, FLA.—The City Council has awarded the contract for lighting the streets of the city for the next year to the St. John's Light & Power Company.

ST. PETERSBURG, FLA.—It is reported that the City Council will submit the proposition to install an electric-light system in St. Petersburg to a vote. W. F. Devine is city clerk.

ATLANTA, GA.—Sealed proposals will be received at the office of the Superintendent of Prisons, Department of Justice, Washington, D. C., until Feb. 14, for furnishing and installing an electric light and power plant in the hospital building at the United States penitentiary at Atlanta, Ga. Plans and specifications, together with information, may be obtained on application at the above office. R. V. Ladow is Superintendent of Prisons.

AUGUSTA, GA.—Contracts have been placed by the Augusta-Aiken Railway & Electric Company with the General Electric Company, of Schenectady, N. Y., for electric generating machinery, with a rating of 3600 hp, which will increase the output of the company to 6600 hp.

COLLEGE PARK, GA.—The City of College Park is reported to have sold $65,000 in bonds, of which the proceeds of $15,000 will be used for the installation of an electric light plant.

CORNELIA, GA.—The Wefford Shoals Light & Power Company, which owns two water-power sites in Banks County, about three miles from Cornelia, capable of developing 4000 hp, is contemplating further developments during the coming year. All the main transmission lines of the company are constructed for 11,000 volts. J. A. Wells is secretary and manager.

LA FAYETTE, GA.—The municipal electric-light plant and water-works system have been completed and placed in operation. The plant was built by the J. B. McCrary Company, of Atlanta, Ga., and cost $40,000.

SWAINSBORO, GA.—The City Council is contemplating calling an election to vote on the proposition to issue bonds, the proceeds to be used to establish a municipal electric-light system. The purchase of the local plant is said to be under consideration. Jesse Thompson is Mayor.

MALAD CITY, IDAHO.—The Idaho Light & Power Company is contemplating extending its transmission lines to Downey and St. John, a distance of about fifteen miles, serving a population of about 3000. The company also proposes to increase the output of its plant by about 500 hp. C. F. Little is secretary and manager.

GLEN ELLYN, ILL.—The Spalding Electric Company will install a 150-hp boiler and two generators in the near future. Carl S. Spalding is manager.

LA SALLE, ILL.—Plans are being prepared by Edward Byrne, city engineer, for the installation of an electric light system for the city, to cost about $10,000.

LINCOLN, ILL.—The Lincoln Water & Light Company is contemplating changing its system to 60-cycle, three-phase, and increasing the output of its plant within the next six months. E. MacDonald is superintendent.

MT. OLIVE, ILL.—Extensive additions and improvements are contemplated for the municipal electric plant, which will include the installation of an additional water-tube boiler with a rating of from 200 to 300 hp, generator and engine, details of which have not yet been decided upon. O. A. Voepel is manager.

MURPHYSBORO, ILL.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Feb. 23, for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States post office building at Murphysboro, Ill., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Murphysboro, Ill., or from the above office. James Knox Taylor is Supervising Architect.

PALESTINE, ILL.—The municipal light committee has contracted with the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for the installation of a series tungsten lamp street-lighting system. When the new system is completed the present arc-lamp system will be discarded. Plans are being considered for the installation of a new generator in the spring. About six miles of new wire will be needed. H. T. Loughery is chairman of light committee.

PEORIA, ILL.—Sealed proposals will be received by the East Peoria Drainage and Levee District, Tazewell County, Ill., Peoria, Ill., until Feb. 3, for the following work: Section 9—Levee and muck ditch, 165,500 cu. yd. Section 10—Drainage ditches, 64,300 cu. yd. Sections 11 and 12—Furnishing and erecting a complete drainage pumping plant, including excavations, foundations, building and machinery. The pumping plant to have a capacity of 33 cu. ft. per second, against a maximum static head of 22 ft. The equipment to consist of two centrifugal pumps, two induction motors, of sufficient rating to operate the pumps at specified capacity, two speed-reducing transmission gears, and all auxiliary appurtenances, including priming apparatus, switchboard, station wiring, etc. For further information address the Harman Engineering Company, 120 Fredonia Avenue, Peoria, Ill. Horace Clark, Eugene Brown and James Millard are commissioners.

ROBINSON, ILL.—It is expected that the plant and holdings of the Robinson Water, Light & Heat Company will be sold at public sale in the near future. Improvements to the plant, including the installation of additional equipment and the erection of seven miles of 6600-volt transmission line to Palestine, Ill., will probably follow the sale. Edward B. Pollister is manager.

SEARS, ILL.—Contracts have been placed by Samuel S. Davis and Thomas B. Davis with the Westinghouse Electric & Manufacturing Company for part of the equipment for the Sears power development, consisting of six vertical generators, one motor-generator set, one exciter and a 17-panel switchboard and accessories.

VIRGINIA, ILL.—The Virginia Light, Heat & Power Company will make improvements to its plant this year, including the installation of a 150-hp Frost boiler and a 200-hp engine. Roy Ray is manager.

GASTON, IND.—Preparations are being made by R. A. Brown for the installation of an electric-light and power plant to supply electricity for lamps and motors in Gaston. It is reported that Mr. Brown is in the market for equipment for the plant.

INDIANAPOLIS, IND.—The Big Four Railroad is erecting a third telephone wire between Indianapolis and Cincinnati. One is used for train dispatching, the other for operators in the different blocks and the third will be used as the message wire.

KNIGHTSTOWN, IND.—Plans are being prepared for rebuilding the entire distributing system of the municipal eletcric light plant during 1911. A. M. Chance is superintendent.

MISHAWAKA, IND.—The City Council has decided to erect a new pumping station in East Mishawaka to pump water from the wells, for which plans are now being prepared. The pumps will be operated by electricity.

PORTLAND, IND.—The controversy over the installation of the power plant, purchased more than a year ago from the Ames Iron Works, of Oswego, N. Y., has ended by the entering of the judgment against the city for $5,500, covering the final payment due on the purchase. The injunction suit filed by L. S. Burkett against the consummation of the deal for the machinery was dismissed.

TIPTON, IND.—Plans are being considered for the installation of a 500-hp boiler and possibly a new dynamo and other minor improvements in the municipal electric light plant in the spring. N. Hiatt is superintendent.

WABASH, IND.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Feb. 18 for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and electric wiring, of the United States post office building at Wabash, Ind., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Wabash, Ind., or at the above office. James Knox Taylor is Supervising Architect.

WARREN, IND.—Plans are being considered for establishing a day service in connection with the municipal electric plant and the installation of a 50-kw to 60-kw, direct-current generator. Additional lamps will be installed. The company would like to purchase a second-hand dynamo. W. H. Hickerson is superintendent.

ATLANTIC, IA.—T. E. Nichols, manager of the municipal electric light plant, writes that the plant will be entirely rebuilt in the near future. It is proposed to increase the output by 500 kw and change the system to two-phase, 60-cycle, 2200-volt, plans for which are being prepared by the W. K. Palmer Company, of Kansas City, Mo.

BOONE, IA.—The Boone Electric Company is contemplating the installation of new equipment in its power house, consisting of four 300-hp boilers, one 500-kw, three-phase, 60-cycle, 2300-volt generating unit, one 200-kw, direct-current, 500-volt motor generator set for street railway service, switchboard, etc., for above. A new smokestack 210 ft. high is being erected and the company will purchase three new cars. John Reynolds is president and manager.

GRISWOLD, IA.—The Griswold Milling & Light Company is planning to extend its transmission line to Elliott, a distance of seven miles, in the spring. J. W. Daily is owner and manager.

GRUNDY CENTER, IA.—The Grundy Center Electric Company is contemplating substituting series tungsten lamps for the 9.6-amp arc lamps which are now in use and also establishing a day service. The company has recently purchased a 75-kw General Electric three-phase alternator and is planning to extend its transmission lines to the village of Holland this summer to supply electricity for lamps. A storage battery is also being installed to supply electric lighting service to country residences. J. B. Calderwood is owner and manager of the plant.

INDEPENDENCE, IA.—Plans are being considered for enlarging the municipal electric light plant, which will include an addition to the power house and the installation of a 250-kw generator and engine. E. R. Stanard is superintendent.

MARSHALLTOWN, IA.—Preparations are being made by the Merchants, Mechanics & Farmers' Telephone Company to begin work on the construction of its new exchange building about March 1. An automatic telephone system will be installed.

MASON CITY, IA.—The City Council is reported to be contemplating building a municipal railway from the city limits to the pumping station.

McCALLSBURG, IA.—The local telephone exchange building is reported to have been destroyed by fire recently.

WEBSTER CITY, IA.—The city is reported to have purchased a site for the proposed new power plant, work on which will begin as soon as the weather will permit.

LEAVENWORTH, KAN.—Bids will be received at the office of the Superintendent of Prisons, Department of Justice, Washington, D. C., until Feb. 16, for furnishing and installing an electric light and power plant in the hospital building at the United States penitentiary building at Leavenworth, Kan. Copies of specifications, together with further information, can be obtained upon application to the above office. R. V. Ladow is Superintendent of Prisons.

STAFFORD, KAN.—The contract for reconstructing the electric light plant and water-works system has been awarded to Joseph A. Bartenlanger, of Omaha, Neb. The cost of the work is estimated at about $36,000.

WILSON, KAN.—The Wilson Electric Light Company is building a new power plant and will change the system from direct to alternating current. Upon completion of the new system the old plant will be discarded. John Weber is manager.

LOUISVILLE, KY.—The contract for installing an electric elevator in the new City Hall has been awarded to the American Machine Company, of Louisville, Ky., to cost about $5,000.

NICHOLASVILLE, KY.—Plans are being considered for the in-

stallation of a 150-hp boiler and a 75-hp steam engine in the municipal electric-light plant during the next six months. E. J. Glass is manager.

WATERVILLE, MAINE.—The Central Maine Power Company has recently acquired the plant and holdings of the Vassalboro Electric Light & Power Company, of Vassalboro, Maine, which is located at Winchester and supplies electricity in Vassalboro, North Vassalboro, Winslow and vicinity. The Central Maine Power Company is planning to erect a transmission line from its Fort Fairfax power house on the Sebasticook River through Winslow to North Attleboro. When the line is completed electricity for operating the system of the Vassalboro company will be supplied from the Fort Fairfax power house. The stockholders of the Central Maine Power Company have voted to increase the capital stock of the company by $150,000, making the total capitalization $3,150,000.

ELLICOTT CITY, MD.—The Patapsco Electric & Manufacturing Company is contemplating the installation of a gas producer and gas engines. Otto Wunder is superintendent.

HAVERHILL, MASS.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Feb. 15 for a conduit and wiring system and extension of present gas piping system at the United States post office building at Haverhill, Mass., plans and specifications for which may be obtained at the above office or of the custodian at Haverhill, Mass. James Knox Taylor is Supervising Architect.

HUNTINGTON, MASS.—Eugene E. Davis, of Northampton, Mass., is reported to have purchased the property known as Stowell's Flats, with water rights. It is understood that he proposes to erect a power plant.

WEYMOUTH, MASS.—The Weymouth Light & Power Company is reported to have purchased the old Pine Point hotel property on the Weymouth side of the Quincy Point bridge, on which it proposes to erect a large power plant.

DURAND, MICH.—Bonds to the amount of $12,000 have been authorized by the city, the proceeds to be used for extensions to the municipal electric light plant and water-works system. New equipment to be installed will include one 200-kva generator and one 75-kva generator and a 275-hp engine and alternating-current motors of from 20 hp to 50 hp to operate pumps. As yet no machinery has been purchased. A day service for lamps and motors will be established after April 1. H. F. Rosenkrans is manager.

MT. CLEMENS, MICH.—The Eastern Michigan Edison Electric Company is reported to be contemplating the erection of a new steam-driven power plant near Amy, Mich.

MUSKEGON, MICH.—The United Home Telephone Company, of Ludington, Mich., and the Independent Telephone Company, of Muskegon, Mich., have practically decided to consolidate. The new company proposes to take over all the independent telephone lines in western Michigan as far north as Manistee, with the exception of Grand Rapids. The new company will be capitalized at $500,000.

STURGIS, MICH.—J. S. Flanders, manager of the municipal electric light plant, writes that it is expected to have the hydroelectric plant ready for operation in April, 1911. The equipment will consist of two direct-connected units of 550 kw each. Sixteen and one-half miles of transmission lines carrying 23,000 volts will be erected.

YALE, MICH.—Plans are being considered for making improvements and extensions to the municipal electric light plant, which will include the installation of another unit and changing the system from direct current to alternating current. R. G. Green is superintendent.

DULUTH, MINN.—It is reported that the Great Northern Power Company is contemplating extensions to its system which will involve an expenditure of about $1,000,000 and include the erection of a substation in Superior and duplicate transmission lines so as to avoid interruptions in its service.

HIBBING, MINN.—The erection of an electric transmission line from the local municipal electric plant to the Village of Alice is under way. It is expected to have the line completed in the near future, when the municipal plant will supply electricity in Alice for lamps and motors.

KENYON, MINN.—Preparations are being made by M. T. Gunderson, owner of the local electric light plant, to establish a twenty-four service for lamps and motors.

ST. PAUL, MINN.—Col. J. H. Davidson, of the State Waterways Commission, recommends the construction of a 6000-hp steam plant as an auxiliary to the hydroelectric power plant to be erected at the high dam.

TUPELO, MISS.—The City of Tupelo will soon issue $50,000 in bonds, of which the proceeds of $15,000 will be used for improvements to the municipal electric-light plant. It is proposed to change the system from direct to alternating current and to install larger engines. W. H. St. John is superintendent.

CENTRALIA, MO.—The Centralia Light & Power Company is erecting a transmission line from Centralia to Mexico, Mo. When completed electricity for operating the local system will be obtained from the power house at Mexico. Current will be received at 11,000 volts stepped up to 16,500 volts for transmission and stepped down to 1100 volts, 60 cycle, three phase, for distribution in Centralia. The company will also supply electricity in Thompson, a small village along the line. R. H. Baldridge is president and manager.

FORSYTH, MO.—It is reported that John A. Laird, of St. Louis, Mo., is interested in a project to build a hydroelectric power plant on White River, three miles from Forsyth, where it is estimated that 2500 hp can be developed, at a cost of from $300,000 to $400,000. Electricity generated at the plant will be transmitted to Forsyth and Springfield, Mo. Mr. Laird has applied to the War Department for approval of the plan to build a dam across the White River.

NORBORNE, MO.—The Norborne Fuel, Ice & Light Company is considering the question of operating a steam-heating business in connection with its plant, using exhaust steam. F. S. Cunningham is secretary and manager.

SPRINGFIELD, MO.—It is reported that a project is under way to construct a hydroelectric power plant on the James River. W. H. Standish and associates are interested.

FREMONT, NEB.—The Fremont Gas & Electric Light Company is reported to be contemplating extensions to its system during the year.

FREMONT, NEB.—The City Council is reported to have decided to install an electrolier lighting system in the business section of the city.

FULLERTON, NEB.—The Nebraska Telephone Company has taken over the property of the Fullerton Telephone Company, the consideration being $17,000.

GRAND ISLAND, NEB.—Preparations are being made by the Grand Island Electric Company to install a 350-kw generator and engine. T. H. Fritts is secretary and manager.

McCOOK, NEB.—The McCook Electric Company is extending its transmission lines into the surrounding country to supply electricity for lamps and motors to the farmers, and also to operate pumps for irrigating purposes. A. R. Scott is manager.

SPENCER, NEB.—Arrangements are being made by W. J. Woods for the installation of an electric light plant, at a cost of about $8,000. The equipment will consist of two 35-hp gas engines and two generators with sufficient rating to supply 3000 16-cp lamps.

RENO, NEV.—It is reported that work will soon begin on the construction of a new power plant on the Truckee River by Stone & Webster, of Boston, Mass., who control the Reno Power, Light & Water Company, the Truckee River General Electric Company and other plants in Nevada and California. The new plant will be the largest on the Truckee River.

DOVER, N. J.—The Public Utility Commission has granted the petition of the Rockaway Electric Light & Improvement Company, of Rockaway, N. J., and the Dover Electric Light Company, of Dover, to consolidate under the name of the Dover Electric Light Company.

SOUTH AMBOY, N. J.—Mayor Michael A. Welsh has recommended the appointment of a committee to make investigations in regard to establishment of a municipal electric light plant in South Amboy, N. J.

FRANKLIN, N. Y.—The Delaware & Otsego Light & Power Company is contemplating extending its transmission lines to Sidney Center, N. Y., within the next two months. E. A. Mackey is president and manager.

FULTON, N. Y.—The Fulton Light, Heat & Power Company has awarded the contract for the construction of a new steam power plant at the corner of East First Street and Van Buren Street. The initial installation will provide for an output of 1000 hp.

MOUNT VERNON, N. Y.—The Public Service Commission, Second District, has granted the Westchester Lighting Company authority to issue $2,824,000 in bonds, the proceeds to be used to discharge the indebtedness of the New York Suburban Gas Company, amounting to $343,000, which was taken over by the Westchester Lighting Company, Dec. 1, 1900, and the remainder to pay off the indebtedness to the Consolidated Gas Company on certain notes.

NEW YORK, N. Y.—Announcement has been made that a syndicate of Boston capitalists has purchased the property and holdings of the Long Acre Electric Light & Power Company. It is understood that the new owners are planning to begin work on the construction of an electric plant, which will involve an expenditure of at least $10,000,000. James F. Shaw, of Boston, Mass., has been elected president of the company.

OLEAN, N. Y.—The installation of a municipal electric light plant is under consideration by the City Council. At present it costs the city about $12,000 for lighting the streets and public buildings. The purchase of the local plant has been suggested, if it can be secured at a reasonable price. The installation of an electric plant at the pumping station has also been considered.

SODUS, N. Y.—The Sodus Gas & Electric Company is contemplating extending its transmission lines eastward to Wolcott, N. Y., and beyond, to supply electricity for lamps and motors in Alton, Wallington, North Rose, Rose, Butler, Red Creek, Wolcott and surrounding country. The company will supply electricity for the plant of O. M. Curtiss, of Wolcott, which is now operated by steam power. The proposed extensions will be financed by Wolcott people, who may form a stock company. The Sodus company purchases energy for operating its system from the Rochester Railway & Light Company, of Rochester, N. Y. G. R. Mills is secretary and manager.

WINSTON-SALEM, N. C.—The Carolina Traction Company is reported to have decided to award contracts immediately for the construction of its proposed electric railway from Winston-Salem, via Rural Hall, Lawsonville and Danbury, N. C., to Floyd, Va., a distance of 102 miles. This will include a branch to Danbury, N. C. S. P. McKnight, of Southern Pines, N. C., is promoter.

CHARDON, OHIO.—The purchase of a hot-water exhaust steam boiler-feed heater for the municipal electric-light plant is under consideration. G. L. Chapman is secretary of Board of Public Works.

CLEVELAND, OHIO.—Plans are being considered to utilize electricity from the municipal electric light plant in old South Brooklyn to operate the garbage plant at Willow Station. It is proposed to extend the transmission lines from the power plant over the river on the Denison-Harvard bridge. This plant would give the city an auxiliary lighting plant in the far southeast section of the city.

MADISONVILLE, OHIO.—The question of installing a 100-kw, 2200-volt, direct-connected unit in the municipal electric-light plant in the near future is under consideration. D. H. Fisher is general manager.

NEW PHILADELPHIA, OHIO.—The telephone exchange building of the Tuscarawas County Telephone Company in New Philadelphia, Ohio, was destroyed by fire on Jan. 9, causing a loss of about $20,000.

FORAKER, OKLA.—The question of issuing bonds to the amount of $30,000 is under consideration, the proceeds of $5,000 to be used for the installation of an electric light plant and $25,000 for water-works system.

GROVE, OKLA.—Application has been made to the City Council for a franchise to construct and operate an electric-light system in Grove. W. T. and O. W. Killam are interested in the project.

WAUKOMIS, OKLA.—A. Williams, of Ames, Okla., is planning to install an electric light plant in Waukomis, Okla., to supply electricity for lamps. Application has already been made for a franchise.

BANDON, ORE.—The question of erecting electric lamps along the north and south jetties at the mouth of the Coquille River to light the harbor at night is under consideration by the City Council.

EUGENE, ORE.—The Dodge department store is reported to be contemplating the installation of a lighting plant in the near future.

KLAMATH FALLS, ORE.—Preparations are being made by the Pacific Telephone Company for extensive improvements to its local system which will involve an expenditure of about $30,000.

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until March 24, for furnishing rack railway material for the Panama Canal locks, including rack steel cross ties, bolts and nuts, tie clips, washers, steel channels, rail bonds, copper conductor rails, steel conductor rails, insulators, bumpers, frogs, switches, etc. Blanks and general information relating to this circular (No. 619) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 55 National Realty Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

CANTON, PA.—Plans are being prepared by the Canton Illuminating Company for extensive improvements to its plant and system during the coming summer. The company will purchase one 150-kw, alternating-current, three-phase, 60-cycle, 2300-volt generator, switchboard, transformers and controller for series tungsten lamps; also about six miles of waterproof transmission wire. The storage battery will be taken out and a twenty-four hour service established. H. L. Clark is secretary and manager.

COATESVILLE, PA.—It is reported that New York and Philadelphia capitalists, who are supposed to represent the McCall Ferry Power Company, have secured an option of the property of the Consumers' Electric Light, Heat & Power Company, of Coatesville. The same parties have obtained control of the Parkesburg Electric Company, of Parkesburg, and the Chester Valley Electric Company, of Downington, Pa., by long leases, and it is said that efforts are now being made to obtain control of the Edison Illuminating Company, of West Chester, which would give them practically entire control of the electric light and power business in Chester County.

EBENSBURG, PA.—The capital stock of the Ebensburg Light, Heat & Power Company has been increased from $50,000 to $100,000.

HASTINGS, PA.—The question of establishing a municipal electric light plant in Hastings is reported to be under consideration.

MOUNT CARMEL, PA.—The Borough Council has granted a franchise to a new company to construct and operate an electric light plant in Mount Carmel. Charles L. Cleaver, Charles A. Goldschmidt and Charles H. Robins, all of Mount Carmel, are parties named in the application for the franchise.

PHILADELPHIA, PA.—Plans have been approved by Mayor Reyburn for the installation of ornamental street lamps on Fifty-second Street, West Philadelphia.

READING, PA.—It is reported that the Klapperthal electric plant, owned by the Metropolitan Electric Light Company, of Reading, Pa., will be rebuilt at a cost of about $200,000.

SOUTH FORK, PA.—The South Fork Electric Light, Heat & Power Company is building a new power house and will install new boilers, new engines and extend its transmission lines to Summerhill and Rockville and establish a day service after June 1, 1911. The borough street-lighting service will be extended, including both arc and incandescent lamps. J. C. Bauerle is manager.

WILKES-BARRE, PA.—The Wilkes-Barre Light Company, incorporated under the laws of the State of Pennsylvania in 1910, will commence building operations Feb. 1. A modern plant will be installed. J. A. Murray is consulting engineer. The offices of the company are located at 54 Public Square, Wilkes-Barre, Pa.

WYOMISSING, PA.—The Borough Council is reported to be considering the question of issuing $60,000 in bonds, the proceeds to be used for the installation of an electric light plant and water-works system.

BRISTOL, TENN.—L. S. Randolph, of Blacksburg, Va., is reported to have been engaged to make investigations and report on the proposed hydroelectric power development in East Tennessee, near Bristol.

MEMPHIS, TENN.—Plans are being considered by the Shelby County Commissioners for the installation of an electric plant to furnish electricity for the court house building. The cost of the plant is estimated at about $10,000. George B. Coleman is chairman of the committee.

MURFREESBORO, TENN.—The installation of an electric light plant in Murfreesboro is reported to be under consideration. John Davis and Thomas Elam are interested in the project.

NASHVILLE, TENN.—The Nashville Interurban Railway Company, of Nashville, Tenn., which operates an electric railway from Franklin to Nashville, a distance of twenty miles, is planning to extend the railway from Nashville to Gallatin. The company has engaged the W. K. Palmer Company, Dwight Building, Kansas City, Mo., engineers, to make surveys, prepare plans and take charge of the construction of the road.

BEAUMONT, TEX.—Announcement has been made by James F. Weed, receiver of the Beaumont Traction Company, that if the Federal Court grants his application for authority to accept the new franchise granted the company by the City Council and to issue $125,000 in receiver's certificates he will make important extensions to the railway and other improvements to the property.

CANYON, TEX.—The City Council has granted L. T. Lester, L. E. Cowling and associates a franchise to construct and operate an electric-light plant in Canyon for a term of twenty-five years.

FORT BLISS, TEX.—Preliminary steps have been taken by the War Department toward the installation of an electric-light plant at the Fort Bliss military post to cost from $17,000 to $24,000.

FORT WORTH, TEX.—The Northern Texas Traction Company has filed an amendment to its charter increasing its capital stock from $3,500,000 to $4,500,000. This company operates an interurban electric railway between Dallas and Fort Worth.

FORT WORTH, TEX.—At an election held Jan. 12 the citizens voted to issue $2,000,000 in bonds, the proceeds to be used for water works and other municipal improvements. Extensions will be made to the street-lighting system, which will involve an expenditure of $40,000. About $90,000 will be expended for improvements to the fire-alarm system.

HOUSTON, TEX.—The Houston Electric Company is reported to be contemplating extensive improvements to its system, including the extension of new track, etc., which will involve an expenditure of $400,000.

MARBLE FALLS, TEX.—A suit brought by Herman Richter, of Burnet, Tex., against the Colorado River Power Company, which is building a large dam across the Colorado River and installing a hydroelectric power plant at Marble Falls, for $50,000 alleged damages for diversion of water rights claimed by plaintiff has been decided in favor of the defendant company by Judge Clarence Martin of the district court. He holds in this decision that the rights of the company were superior to Mr. Richter's by virtue of its files and construction of the dam.

NEW BRAUNFELS, TEX.—A special measure has been prepared by Senator Weinert, of Seguin, Tex., to be presented to the State Legislature providing for the construction of a hydroelectric plant at any point on the Guadalupe River within twelve miles in either direction from the town of New Braunfels. The bill includes the right to the City of New Braunfels of eminent domain and condemnation proceedings to acquire riparian rights, water rights, dams, etc., necessary in carrying out the hydroelectric project.

SAN ANGELO, TEX.—An effort is being made to bond the property of the San Angelo Street Railway Company for $50,000 to secure funds for extensions and improvements to the property. If the bonding proposition is not put through the property will be sold at foreclosure sale early in March to satisfy a judgment of $30,000, held by Samuel Crowther, formerly president of the company. John W. Harris was recently elected president to succeed Mr. Crowther, and Charles B. Metcalf, secretary and treasurer.

WAXAHACHIE, TEX.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Jan. 17, for construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States post office at Waxahachie, Tex., in accordance with drawing and specifications, copies of which may be obtained at the above office or from the custodian of site at Waxahachie. James Knox Taylor is Supervising Architect.

WATERFORD, VT.—The development of the water-power of the Connecticut River at Fifteen Mile Falls, in Waterford, Vt., is reported to be under consideration. It is estimated that 50,000 hp could be developed. The cost of the power plant and transmission is estimated at between $6,000,000 and $7,000,000. Electricity generated at the plant would be transmitted to Montpelier and Barre, Vt.; St. Johnsbury, N. H.; Littleton, N. H., and other towns and cities in Vermont and New Hampshire. Messrs. Chase & Harriman, who are connected with the

plant of the Connecticut River Power Company, at Vernon, Vt., are interested in the project.

RICHMOND, VA.—E. W. Trafford, engineer of the municipal electric light plant, has presented his first budget, asking for $124,113 for annual maintenance and for construction and equipment as follows: On the distributing system Mr. Trafford estimates that it will require $49,321 to complete existing contracts; $1,000 for steel towers over the Chesapeake & Ohio Railway tracks; for installation of the Washington Ward distributing system, $11,459; additional lamps, $5,000; ornamental lamps for Jefferson Avenue, $4,000. The engineer reported that the plant would be completed within the original amount appropriated by the Council, but that contingent expenses, extension of dams and improvements have increased the total cost by $10,000 more than was estimated. In view of the proposed lighting system in Washington Ward, Mr. Trafford recommended the installation of an additional generator at the plant, wiring equipment and 125 lamps, making the total cost for the installation $19,910.

WARRENTON, VA.—It is reported that the local electric-light plant has been purchased by M. M. O'Connell & Son, of Washington, D. C. The price paid for the plant is said to be $20,000.

CONCONULLY, WASH.—The Pacific Coast Telephone Company is contemplating the erection of new telephone lines, one to run over the Silver Hill country and another through the Pine Creek region. T. R. Pinkerton is local manager.

MONTESANO, WASH.—The contract for installing the electric clock and system in the new Court House has been awarded to Joseph Mayer & Brothers, of Seattle, Wash., for $2,600.

NORTH YAKIMA, WASH.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Feb. 18, for the construction complete, except elevator, but including plumbing, gas piping, heating apparatus, electric conduit and wiring, of the United States post office building at North Yakima, Wash., in accordance with drawings and specifications, copies of which may be obtained at the above office or from the custodian of site at North Yakima, Wash. James Knox Taylor is Supervising Architect.

PORT TOWNSEND, WASH.—The Board of County Commissioners has granted a fifty-year franchise to the Olympia Power Company to erect an electric transmission line on the highways of the county. The company proposes to erect a hydroelectric power plant on the Elwha River, where 6000 hp will be developed.

TACOMA, WASH.—Bids will be received by Nicholas Lawson, Commissioner of Light and Water, City Hall, Tacoma, Wash., until Feb. 6 for material and equipment for completing the municipal hydroelectric plant at La Grande, on Nisqually River as follows: Section 1—Bridge, estimated cost, $44,890; section 2, conduit and reservoir, $292,675; section 3, pressure pipes and anchor piers, $116,696; section 4, power house, cranes and cableway, $149,875; section 5, water-wheels and generators, $168,733; section 6, electrical equipment, power house, $88,573; section 7, electrical equipment, substation, $109,690; section 8, transmission line, $100,000. H. F. Groner is chief engineer.

CLARKSBURG, W. VA.—The Jacobs Realty Company, recently organized, to deal in real estate, etc., proposes to operate a water, light and power plant. The incorporators are: D. W. Jacobs, John W. Jacobs, C. E. Prunty, and others, all of Clarksburg, W. Va.

WHEELING, W. VA.—Plans are being considered by the Wheeling Electrical Company for the erection of a new plant, at a cost of about $700,000, which will be erected on the site of the old plant on the South Side.

NEW LISBON, WIS.—At a special election held Jan. 5 the proposition to establish a municipal electric light plant and water-works system was carried.

EDMONDS, B. C., CAN.—Plans have been prepared by the British Columbia Electric Railway Company for the erection of a substation and depot in Edmonds.

KAMLOOPS, B. C., CAN.—The City Council is considering the question of installing a municipal telephone system.

VANCOUVER, B. C., CAN.—The British Columbia Telephone Company has decided to build a steamer for laying telephone cable, the cost of which is estimated at $30,000.

VANCOUVER, B. C., CAN.—Plans have been prepared by the British Columbia Telephone Company for the erection of new telephone exchanges at Kamloops, Nelson, Alberni and Duncans, all in British Columbia.

PORTAGE LA PRAIRIE, MAN., CAN.—The Manitoba Power Company is reported to have notified the City Council that it proposes to submit a proposition to supply the city with power from its concession on the Winnipeg River.

EDMUNDSTON, N. B., CAN.—The town of Edmundston has applied to the Legislature for authority to issue bonds to the amount of $40,000, the proceeds to be used to establish an electric light and power plant in Edmundston, and to build and maintain a dam at the second falls on Green River to supply power for same.

DUNDAS, ONT., CAN.—The by-law authorizing a contract with the Hydroelectric Power Commission and appropriating $12,000 to erect a portion of the distributing system in Dundas has been approved by the Town Council.

KINGSTON, ONT., CAN.—It is reported that Iroquois (Ont.) capitalists have acquired the water-powers adjacent to Calabogie and High Falls, which they propose to develop. Electricity generated at the plant will be transmitted to Kingston. M. Beach, of Iroquois, Ont., is interested in the project.

LONDON, ONT., CAN.—At a meeting of the board of directors of the London & Port Stanley Railway Company it was decided to authorize the city engineering department to prepare estimates of the probable cost of the work. This railway is controlled by the City of London, and Mayor Beattie has been elected president of the board for the ensuing year, and Alderman Saunders vice-president.

LONDON, ONT., CAN.—At the annual meeting of the stockholders of the London Electric Company the directors were authorized to make improvements to the plant and equipment of the company in order to compete with the new municipal distributing plant of the city, electricity for which will be supplied by the Hydro-Electric Power Commission. It is understood that work will begin on the proposed improvements about Feb. 1 and that a new type of gas or oil engine, now being manufactured in England, will replace the steam engines now in use. The company has notified the city of its withdrawal of all previous offers for the sale of its plant and business to the city. The City Council, on the other hand, will make application to the Provincial Legislature for authority to purchase the plant and holdings of the company.

ORILLIA, ONT., CAN.—The municipal electric plant at Orillia was damaged on Jan. 19 owing to the bursting of the flume supplying water at the Ragged Rapids power house. It is expected that the plant will be ready to be placed in operation within two weeks.

OTTAWA, ONT., CAN.—It is reported that an electric smelting plant will be erected at Chat Falls, on the Ottawa River, twenty miles north of Ottawa. American and English capitalists are interested in the project. Work on construction of the plant will begin in the spring.

PORT HOPE, ONT., CAN.—The ratepayers on Jan. 17 passed a by-law granting the Seymour Electric Company a thirty-year franchise to supply electricity in Seymour, Ind.

TORONTO, ONT., CAN.—Bids will be received until Jan. 28 by the chairman of the building committee for material and equipment for the erection of a power house in connection with the Toronto General Hospital. Darling & Pearson, 2 Leader Lane, Toronto, Ont., are architects.

WELLAND, ONT., CAN.—The Falls Power Company, of Welland, Ont., has sold its plant and holdings to the Welland Electrical Company, including the contract for lighting the streets of the town.

SHERBROOKE, QUE., CAN.—The contract for the development of the Drop Off power in Sherbrooke has been awarded to Morrow & Beattie, of Peterborough, Ont., Can., for $51,220 (not including the hydraulic or electrical equipment), providing it meets the approval of the Board of Control, city attorney and city engineer. Ross & Holgate, engineers, of Montreal, Que., will supervise the construction of the plant. The cost of the development complete is estimated at $100,000.

REGINA, SASK., CAN.—Plans have been prepared for extensive additions and improvements to the municipal electric plant this year which will involve an expenditure of about $115,000. The plans include the installation of electrical machinery, bids for which have been asked. A. J. McPherson is City Commissioner.

EL TIGRE, SONORA, MEX.—All concessions and right-of-way for the proposed electric transmission line that is to be erected to this mining district from the power plant of the Copper Queen Company in Douglas, Ariz., have been obtained. The proposed line will be sixty-six miles in length and will have a potential of 44,000 volts. The cost of the transmission line, including substations, is estimated at about $150,000.

LEON, GUANAJUATO, MEX.—The Guanajuato Light & Power Company is installing an electric-light system in Leon.

New Industrial Companies.

THE PHIFER ENGINE MANUFACTURING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $50,000. The incorporators are: J. M. Frere, V. Atkinson and R. Seidlinger, of Wilmington, Del.

THE RADIO GAS PRODUCER COMPANY, of St. Louis, Mo., has filed articles of incorporation with a capital stock of $50,000 for the purpose of manufacturing electrical apparatus, etc. The incorporators are: J. W. Kolar, A. J. Cunningham, M. C. Burgman and others.

THE ROBERT W. HUNT & COMPANY, LTD., of Montreal, Que., Can., has been incorporated by J. W. Moffat, T. C. Irving, Jr., both of Toronto, Ont., Can. The company is capitalized at $50,000 and proposes to carry on a business of civil, mechanical, mining and electrical engineering.

THE SECONDARY CONTROLLER COMPANY, of New York, N. Y., has been chartered by Alphonzo E. Pelham and Richard Van Rennselaer Sill, both of 414 West Twenty-sixth Street; Grafton L. McGill, of 15 William Street, all of New York, N. Y. The company proposes to manufacture and deal in electric controllers, devices, etc.

THE SCHMIDT AUTOMOBILE ELECTRIC AIR PUMP COMPANY, of Hazleton, Pa., has been incorporated with a capital stock of

$5,000 and the following directors: Isaac Smulyan, of Hazleton, Pa., treasurer; John J. Mulhall, Louis Auerbach and Jacob Benjamin, all of Hazleton, Pa.

THE UNITED STATES ENGINEERING & MANUFACTURING COMPANY has filed articles of incorporation with the Secretary of State, Dover, Del., with a capital stock of $1,000,000. The incorporators are: J. J. Jones, of Pittsburgh, Pa.; M. K. Griffith and J. M. Griffith, of Tarentum, Pa.

THE VILLE ENGINEERING COMPANY, of Moline, Ill., has been chartered with a capital stock of $200,000 to manufacture motors, engines, automobiles, etc. The incorporators are: Willard L. Ville, Lawson M. Fuller and Otis E. Mansur.

THE WEST COAST ELECTRIC BATTERY COMPANY, of San Francisco. Cal., has been incorporated with a capital stock of $100,000 by C. A. Westenberg, F. P. Davis and F. E. Wright.

New Incorporations.

CAMDEN, ARK.—Articles of incorporation have been filed for the Rice Belt Telephone Company with a capital stock of $60,000 by W. B. Ritchie, B. C. Powell and B. C. Blain.

EUREKA, CAL.—The Eel River & Southern Telephone Company has been incorporated with a capital stock of $20,000 by H. D. Smith, E. M. Loveland, R. White and others.

SACRAMENTO, CAL.—The Sacramento Valley Power Company has been granted a charter with a capital stock of $2,000,000. The incorporators are: A. Armstrong, H. E. Willis, D. Righetti, Grant Cordrey, F. V. Vollmer, L. Sutter and E. Maytorena.

DENVER, COL.—The Ellis National Electric Light Company has been incorporated with a capital stock of $1,000,000 by A. L. Hiller, J. H. Stahl and M. McCullough.

WILMINGTON, DEL.—Articles of incorporation have been filed for the Mitchell Water & Light Company with a capital stock of $100,000 by F. M. Shive, S. E. Roberson and H. W. Davis, of Wilmington, Del.

CENTER, IND.—The Center Telephone Company has filed articles of incorporation with a capital stock of $10,000 to construct and operate a telephone exchange in Center and throughout Howard County.

CRYSTAL, IND.—The Columbia Telephone Company has been incorporated to install a telephone system in Crystall and throughout Dubois County. E. E. Ellis is president of the company.

INDIANAPOLIS, IND.—Articles of incorporation have been filed with the Secretary of State for the Wabash River Power Company with a capital stock of $200,000. The company proposes to generate and distribute electricity in towns and cities for lamps, heat and motors. The incorporators are: Horace C. Stillwell, Henry A. Mansfield, Thomas N. Stillwell, J. Walter Esterline and John L. Baker. The principal offices of the company will be located in Indianapolis, Ind.

INDIANAPOLIS, IND.—The Interstate Telephone Company has been incorporated with a capital stock of $75,000 for the purpose of acquiring and operating the existing telephone lines in Davies and Greene counties, now operated under the name of the Interstate Telephone System. Five exchanges are included, located at Odon, Elnora, Montgomery, Epsom and Scotland. The company has in operation about 350 miles of wires and 500 subscribers. It is proposed to extend the system. The incorporators are: Oscar E. Pottorff, R. P. Knight, J. G. Paul and Elizabeth A. Coulter, all of Indianapolis. The main office of the company will be located at 503 K. of P. Building, Indianapolis.

WINCHESTER, IND.—The Farmers' Telephone Company has been incorporated with a capital stock of $10,000 to erect a telephone system in Randolph County. Leander Moorman, Clarence Miller and David Lesley are incorporators.

DES MOINES, IOWA.—The Stony Hill Telephone Company, of Fayette County, has been incorporated with a capital stock of $10,000 by Daniel Brause, E. C. McMargroff, David Saltsgiver and others.

DURANGO, IOWA.—The Rose Valley Telephone Company has been organized for the purpose of erecting a farmers' telephone system. James M. Dunn is president of the company, and J. H. Denhoff is secretary.

ELKADER, IOWA.—The Boardman & Wagner Telephone Company has been granted a charter with a capital stock of $1,000.

NEW CONCORD, KY.—The Fullerton Home Telephone Company has been incorporated by John Arthur, J. R. Shepherd, Lyman Warnock and others.

SHREVEPORT, LA.—The Shreveport & Memphis Railway Company has been chartered by O. C. Ferguson and A. R. Johnson, of Homer, La., to construct an electric or steam railway to connect Eldorado, Homer and Minden, a distance of forty-five miles. It is expected later to extend the railway to Memphis.

MIDDLEBURG, MD.—The Middleburg Telephone Company has been organized to construct a telephone line from Middleburg to Greencastle. J. Frank Hale is manager of the company.

OGDEN CENTER, MICH.—The Ogden Mutual Telephone Company has been incorporated with a capital stock of $5,000 by C. E. Arnold, Ira Ashley, B. W. Baker and others.

VIRGINIA, MINN.—The Northern Minnesota Railway Company has been incorporated by Edward Himes, of Chicago, Ill.; S. J. Gusson, of Virginia, Minn.; G. F. Lindsay, of Davenport, Ia.; William O'Brien, of St. Paul, Minn., and H. C. Hornby, of Cloquet, Minn. The company is capitalized at $25,000 and proposes to build an electric railway in Minnesota.

ORCHARD FARM, MO.—The Orchard Farm Telephone Company has been incorporated with a capital stock of $1,950 by Gustave Kipp, William Schindler and Ernest Nolte.

MISSOULA, MONT.—Articles of incorporation have been filed for the Missoula & Hamilton Railway Company with a capital stock of $500,000 by H. M. Sloan, F. G. Bennett, R. A. O'Hara and Ira M. Cobe. The company proposes to build a railway to connect Hamilton and Missoula, to be operated by either steam or electricity.

CHAPPELL, NEB.—The Farmers' Telephone Company has been incorporated with a capital stock of $2,000 by J. D. Hamel, G. B. Brown and others.

FINESVILLE, N. J.—The Delaware Union Telephone Company has been incorporated with a capital stock of $100,000 by E. Hagar, of Riegelsville, N. J.; E. Frey, of Stewartsville, N. J., and S. Lippincott, of Milford, N. J.

BIRDSALL, N. Y.—The Canaseraga, Jersey Hill & Birdsall Telephone Company has been incorporated with a capital stock of $450 to operate telephone system in the town of Birdsall and also in the townships of Birdsall, Grove and Benns, connecting Birdsall and Canaseraga. The directors are: William Manning, Henry McMahon and John Clancy, all of Birdsall, N. Y.

COLLINS, N. Y.—The Zoar Telephone Company has been chartered with a capital stock of $1,250. The incorporators are: Lynn W. Shipman, Albert A. Gainsler, A. L. Anderson, Frances C. Gransler, Jacob H. Schaach, M. G. Shipman, of Gownada, and C. Mugridge, of Collins Center, N. Y.

AKRON, OHIO.—Articles of incorporation have been filed for the Northern Ohio Power Company with a nominal capital stock of $10,000 by William Christy, Charles H. Lohr, Charles Currie, C. F. More and N. O. Mather. Most of the parties are connected with the Northern Ohio Traction & Light Company. The new company proposes to erect a new power plant at Cuyahoga Falls which will supply electricity for operating the railway system of the Northern Ohio Traction & Light Company and other purposes.

CLEVELAND, OHIO.—The Beighlee Electric Company has been incorporated with a capital stock of $10,000 by H. Earl Beighlee and others.

GREENFIELD, OHIO.—The Greenfield Telephone Company has filed articles of incorporation with a capital stock of $100,000. The incorporators are: Stanley Pike and others.

CONNELSVILLE, OKLA.—Articles of incorporation have been filed for the People's Ice & Light Company by J. M. Middleton, G. H. C. Beirndollar, C. L. Goodale and C. S. McCarty. The company is capitalized at $50,000.

LEXINGTON, OKLA.—Articles of incorporation have been filed for the Good Service Telephone Company with a capital stock of $15,000 by E. M. Abernathy and R. P. Wynne, of Lexington, Okla.; J. L. Abernathy, of Purcell, Okla., and W. F. Wiley, of Oklahoma City, Okla.

NARDIN, OKLA.—The People's Mutual Telephone Company has been incorporated by N. Goin, I. S. Arnold, J. W. Coffelt, J. H. Denhart and A. B. Havins.

OKLAHOMA CITY, OKLA.—The Western Power & Irrigation Company has been incorporated with a capital stock of $500,000 by George W. Trye, C. F. Berryman, of Oklahoma City, Okla., and W. Holton Key, of Maysville, Ky.

SHAWNEE, OKLA.—The Oklahoma Short Line Electric Railway Company has filed articles of incorporation in Oklahoma for the purpose of connecting the electric railways and interurban systems of Kansas, Missouri, Texas and Oklahoma. The main line will be 175 miles in length and will connect Oklahoma City, Okla., and Joplin, Mo. A branch will be constructed from Shawnee, Okla., to Denison, Tex., a distance of 125 miles. Work on construction will begin in the near future. It is proposed to build from Shawnee to Muskogee and Oklahoma City first. The power plant and car shops will be located east of Shawnee. The company is capitalized at $100,000. The incorporators are: C. C. Wright, of Ada; M. J. Bentley, of Tecumseh; Peroy Paddock, of Oklahoma City, and T. E. Armentrout, of Kirkwood, Mo.

WAGNER, OKLA.—Articles of incorporation have been filed for the Interstate Power Company with a capital stock of $1,000,000.

BUTTE FALLS, ORE.—The Butte Falls & Eagle Point Telephone Company has been chartered with a capital stock of $5,000 by Porter J. Neff, W. P. Mealey and L. A. Newton, all of Medford, Ore.

KIMBLES, PA.—The Lackawaxen & Milford Telephone Company has been chartered with a capital stock of $5,000. The directors are: M. C. Rowland, of Kimbles, Pa., treasurer; John D. Weston and John Kuhbach, both of Honesdale, Pa.

JACKSON, TENN.—Articles of incorporation have been filed for the Citizens' Electric Light & Power Company with a capital stock of $1,500

by T. E. Mercer, Eugene Davis, M. B. Mulheron, J. M. Justice and W. Ragland.

NASHVILLE, TENN.—Articles of incorporation have been filed for the Henry M. Moses Electric Company, of Knox County, with a capital stock of $5,000, by Henry M. Moses, H. C. Keeton, B. A. Massey and R. A. Johnston.

LONGVIEW, TEX.—The Port Bolivar Iron Ore Railway Company has been incorporated by L. P. Featherstone, Fox Winnie, L. C. Luckel, W. D. Myers, W. C. Brothers, Eugene A. Wilson, Lewis A. Featherstone, Murrell L. Buckner and T. B. Stinchcomb. The company is capitalized at $50,000 and proposes to build a steam or electric railway from Longview through Gregg, Upshur, Harrison, Marion and Cass Counties to a point in Cass County about ten miles north of Hughes Springs.

OENAVILLE, TEX.—The Oenaville Rural Telephone Company has been incorporated with a capital stock of $1,000 by T. P. Aycock, W. S. Ellicott and W. T. Wright.

LEAMINGTON, UTAH.—The People's Telephone Company, of Leamington Precinct, has been incorporated with a capital stock of $10,000. The officers of the company are: A. M. Roper, president; Leo Lyman, vice-president; J. Greathouse, secretary; J. H. Strange, treasurer, and George Finlinson, manager.

Personal.

MR. W. W. TAYLOR has resigned as manager of the Rawlins (Col.) Electric Light & Power Company and is succeeded by Mr. J. H. Jacobucci.

MR. D. M. BLISS, who joined the Edison engineering staff a year ago as electrical engineer, has been appointed chief engineer of the Edison Laboratory, West Orange, N. J.

MR. WILLIAM P. SIDLEY, of Chicago, vice-president and general counsel in that city for the Western Electric Company, has been elected president of the Young Men's Christian Association of Chicago.

MR. HENRY FLOY has recently completed for a banking interest a complete appraisal of the properties of the Elmira Water, Light & Railway Company, including the interurban electric road between Elmira and Watkins Glen.

MR. W. H. WHITESIDE, who recently resigned from the presidency of the Allis-Chalmers Company, is to sail from New York on Jan. 21 with his family on the *Caronia*, bound for Spain and the Orient, for a holiday of several months.

MR. A. B. WILSON, who has been connected with the Tungstolier Company, of Conneaut, Ohio, for the past two years in charge of its St. Louis district, has been made vice-president and general manager of the Tungstolier Company of Canada, with general offices at Tornoto, Ont.

MR. EUGENE CREED, sales manager of the Toronto Electric Light Company, has been appointed chairman of the commercial committee of the Canadian Electrical Association. Mr. Creed is also a member of the appliance committee of the commercial section of the National Electric Light Association.

MR. HERBERT A. WAGNER, vice-president of the Consolidated Gas, Electric Light & Power Company, of Baltimore, addressed the Baltimore N. E. L. A. section at its last meeting on the subject of "Rates." The meeting was held at the physical laboratory of the Johns Hopkins University, and the room was taxed to accommodate the large audience.

MR. JOHN I. BEGGS, president and general manager of the Milwaukee Electric Railway & Light Company, slipped on the ice while in St. Louis on a visit during the week of Jan. 16, sustaining a bad fall which fractured his right wrist. This injury, however, has not prevented Mr. Beggs from getting about to attend to business, with his arm carried in a sling.

MR. W. B. FOSHAY has resigned as manager of the Pacific Power & Light Company, of Walla Walla, Wash., in order to join the staff of the Washington-Oregon Corporation at Vancouver, Wash. This concern is taking over a number of properties, among them being the gas, electric light and water companies of Vancouver and the Vancouver Interurban Railway, all of which will be under the management of Mr. Foshay.

MR. BION J. ARNOLD has had conferred upon him by the University of Nebraska the honorary degree of doctor of engineering. Mr. Arnold began his higher education in the university which has thus tendered to him the highest degree within its command, completing his technical training in the East. In 1884 he achieved his B. S. from Hillsdale College, Mich.; in 1887 M. S., and two years later M. Ph., from the same institution. The University of Nebraska conferred on him the degree of E. E. in 1898, and in 1907 the Armour Institute gave him the honorary degree of D. Sc. Besides this collection of titles Mr. Arnold received a "diploma extraordinary" in 1907 from his old college at Hillsdale for distinguished learning and achievements in invention and in mechanical and electrical engineering.

MR. WILLIAM S. TURNER has resigned as managing engineer of the Northwestern office of W. S. Barstow & Company at Portland, having practically completed the work upon which he has been engaged in that city during the past three years. This has consisted in a considerable amount of interurban railway construction for the Oregon Electric Railway Company and supervising the contract which W. S. Barstow & Company had for underground electric conduit construction for the Portland Railway, Light & Power Company. Mr. Turner has had long experience in electric railway construction, having been a member of the firm of Woodbridge & Turner, which did a great deal of pioneer work in electric railroading. Later Mr. Turner built some electric railroads in New Zealand for J. G. White & Co., with whom he was connected for some eight years. After a short vacation in the East he expects to make Portland his home and possibly to engage in business there on his own account.

Obituary.

MR. H. C. SCOTT, president of the National Light & Improvement Company, of St. Louis; general manager of the Waco (Tex.) Gas & Electric Company, and president of the Fort Worth (Tex.) Light & Power Company and other Texas electric-service companies, committed suicide by shooting himself Jan. 14 at his residence on Vandeventer Avenue, St. Louis, Mo. Mr. Scott's public-utility holdings are reported to be valued at more than $500,000.

MR. VAN W. WELSH.—A press dispatch from Marietta, Ohio, says that Mr. Van W. Welsh, a prominent business man of that region, was found dead in the electric-light plant in Beverly, Washington County, Ohio, on Jan. 19. Mr. Welsh was president and owner of the Beverly Electric Light Company and he met his death by being caught in the machinery during the temporary absence of the superintendent of the plant. No one witnessed the accident and it is not known exactly how it occurred.

Trade Publications.

AIR-BRAKE EQUIPMENTS.—Bulletin No. 4798, issued by the General Electric Company, describes the straight air-brake equipments manufactured by it for railway service.

BELT LACING.—Bulletin No. 152, issued by the Bristol Company, Waterbury, Conn., describes and illustrates the various types of patent steel belt lacing manufactured by the company.

MINE TELEPHONES.—The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has issued a placard pointing out the possibilities and convenience of its "Mine A Phone" system.

MOTOR-DRIVEN AIR COMPRESSORS.—The line of air compressors built by the General Electric Company for factory, power station, car barn and many other industrial purposes is described in Bulletin No. 4810.

RESISTANCE MATERIALS.—With this title the Driver-Harris Wire Company, of Harrison, N. J., has issued a booklet which, besides containing numerous quick reference tables, lists two new alloys, "Yankee-Silver" and "Therlo," recently perfected by this company.

ELECTRIC CRANES.—Catalog No. 82, issued by the Whiting Foundry Equipment Company, Harvey, Ill., gives in condensed form a description of special features of Whiting cranes, together with views of installations and names of some of the company's principal customers.

GLASSWARE.—The Phœnix Glassware Company, New York, manufacturer of illuminating glassware of all kinds, has issued as Catalog No. 19, a bound price list of over 150 pages devoted to decorated, etched and cut glassware for incandescent electric lamps. The prices and illustrations and sizes are given on facing pages.

INDUCTION MOTORS.—Bulletin No. 3141 of the Emerson Electric Manufacturing Company, St. Louis, Mo., describes its single-phase induction motors in sizes ranging from 0.1 hp to 0.2 hp. In these machines an automatic internal clutch allows the armature to attain speed and develop practically full power before engaging the pulley or load.

FEED-WATER HEATERS.—The Alberger Condenser Company, New York, describes in Catalog No. 14, just issued, its condensing apparatus, but chiefly the Wainwright feed-water heaters, expansion joints, heat extractors and air coolers. The construction and application of these well-known power plant specialties are treated at length.

IRON CABINETS AND BOXES.—The F. Bissell Company, Toledo, Ohio, has issued a bulletin describing its "Security" iron cabinets and boxes. These are made up in one piece with knockouts for cabinet work, pull or junction boxes, weatherproof cut-out work, to inclose motor starters, allowing the handle only to project, entrance switches, etc.

STARTING AND CONTROLLING APPARATUS.—A price list and bulletin of the various automatic starters and controllers for electric motors made by the Monitor Controller Company, Baltimore, Md., has been issued by the Monitor Sales Department, of that city. The list and bulletin is of the pocket-size loose-leaf type and covers the products of the company.

DIRECT-CONNECTED GENERATING SETS.—The General Electric Company has issued Bulletin No. 4804, superseding Bulletin No. 4617, and devoted to a description of its direct-connected generating sets. These are built in sizes ranging from 2½ kw to 75 kw, and although originally designed for marine work are also well adapted for isolated plants or small central-station requirements.

ECONOMICAL FIRE-ROOM METHODS.—Bulletin No. 187, issued by the B. F. Sturtevant Company, of Hyde Park, Mass., is a reprint of an article by Mr. F. R. Low, editor of *Power and the Engineer*, on

economical fire-room methods based on a visit to a New England woolen mill, where by the use of intelligent help recording apparatus, economizers and forced draft fans some remarkable results are obtained.

POLISHING AND GRINDING MOTORS.—The Emerson Electric Manufacturing Company, St. Louis, Mo., offers two distinct styles of motors designed especially for the requirements of dentists, each of which is furnished with chucks and polishing and grinding wheels. The motors are made in both alternating-current and direct-current types for all ordinary voltages and frequencies. Bulletin No. 3708, just issued, describes the line.

MILLING MACHINES.—Circulars Nos. 142 and 143 have been issued by the Garvin Machine Company, of New York. The first is devoted to a vertical spindle milling machine for machining gear and engine casings of automobiles, railway car motor casings, box castings and frames of special machines requiring the finishing of surface joints, spots and edges to varying gage levels and widths, and the second describes and illustrates a duplex milling machine.

ACCIDENT PREVENTER.—The Nelson Valve Company, Philadelphia, Pa., has issued for free distribution circular red cards with white skull, under which is the legend "Danger! Hands Off." The card is intended for tying to valves, switches, etc., whose manipulation would endanger property or the lives of men working on sections of wiring or piping, or as a warning to persons unacquainted with the hazard of certain apparatus, locations, etc.

INSULATION.—The Walpole Rubber Company, Walpole, Mass., which controls the Massachusetts Chemical Company, the well-known manufacturer of insulating compounds and tapes, has issued a neat pamphlet entitled, "A Visit to Walpole," describing the organization of the holding company and the output of its various subsidiaries. The company has recently erected additional buildings in Walpole with every facility for economical manufacture.

BALL BEARINGS.—The Hess-Bright Manufacturing Company, Philadelphia, Pa., has issued Catalog Form 580-A, which is exceptionally well prepared and treats of the development of the annular type of ball bearing; characteristics of plain and ball bearings; the manufacture of ball bearings and their application to automobiles, line shafting, electrical apparatus, etc. Tables giving sizes, dimensions and sustaining capacities of the bearings form part of the catalog.

TESTING APPARATUS.—The Leeds & Northrup Company, Philadelphia, Pa., has issued Catalog No. 40, devoted to apparatus for measuring low resistance and conductivity. The following apparatus is illustrated and described: Standard low resistors, current carrying resistors, apparatus for measuring low resistances and conductivity apparatus. There is also an appendix containing the theory and practice of conductivity measurements. Hoopes' conductivity bridge is described at length.

STEAM TRAPS.—Catalog No. 266 issued by the American Blower Company, Detroit, Mich., is devoted to descriptions and applications of the "Detroit" tilting tank type of steam traps and the "Detroit" return trap system for coil drainage, water lift and automatic boiler feed. A distinctive feature of the Detroit traps is that there are no valves, floats or buckets inside the tank to leak, corrode, rust or stick, and the tilting motion indicates that the trap is doing the work required of it.

ELECTRICAL SHEET STEEL.—The Follansbee Brothers Company, Pittsburgh, Pa., is distributing to motor and transformer manufacturers and others who are interested in electrical sheet steel blueprints showing the magnetic properties of its steel. The steel has exceedingly high permeability, while the loss per pound is very low. Thus, with 60 cycles at a density of 10,000 lines per square centimeter, the loss in watts per pound is 1.38, 1.42, 1.52 or 1.70, according to whether the thickness is 30, 29, 28 or 26 gage.

RAILWAY STORAGE BATTERY INSTALLATION.—Operating between Bangor, Pa., and Nazareth, a distance of approximately fifteen miles, is a small electric railway owned by the Slate Belt lEectric Street Railway Company, Pen Argyl, Pa. Owing to the heavy grades, it was necessary to install a storage battery to maintain the voltage on the line, if the time schedule was to be adhered to. The battery installation is described in Bulletin No. 130, issued by the Electric Storage Battery Company, Philadelphia, Pa.

SWITCHBOARD PANELS.—The General Electric Company has designed for use in small or isolated plants, containing but one generator, alternating-current switchboard panels which are not equipped with buses, generator switch or any synchronizing devices. Two classes of panels, one for controlling a single generator, one exciter and one or two feeders, and the other for controlling one generator, one exciter, one or two feeders and one constant-current transformer, are described in Bulletin No. 4807, just issued.

BELT-DRIVEN ALTERNATORS.—In many small stations the use of the belt drive is unavoidable, because in not a few cases the prime mover is already installed or the speed necessary cannot be obtained by any other means. The General Electric Company has built for a number of years a standard line of alternators for this service, and illustrations and brief descriptions of two-bearing alternators ranging from 30 kw to 200 kw and three-bearing alternators ranging from 250 kw to 550 kw are given in Bulletin No. 4685.

ELEVATING AND CONVEYING MACHINERY.—The Fairbanks Company, New York, has issued illustrated circular and price list No. 482 of power-transmission appliances, belting, shafting, couplings, collars, hangers, pillow blocks, pulleys, friction clutches, rope sheaves, machine-molded gears, scales, etc. The object of the company in the compilation has been to present complete information on its transmission and conveying materials, and by special attention to the illustrations and grouping of the contents it has also made of it a handy book of reference.

TURBO-GENERATORS.—The Rateau-Smoot turbines, which are of the impulse type, are built for mixed flow, low-pressure and high-pressure work. The first two are applicable to existing reciprocating-engine stations, increasing the output from 50 per cent to 100 per cent without increasing the fuel consumption. The Ball & Wood Company, Elizabethport, N. J., manufacturer of these machines, has prepared a well-illustrated catalog on the sets, showing the details of construction of the turbines and generators and pointing out the advantages of the respective types for various classes of work.

UTILIZATION OF SMALL WATER-POWERS.—Under the title "Water-Powers of the Third Magnitude" the American Spiral Pipe Works, of Chicago, issue an attractive pamphlet telling the interesting story of the hydroelectric development of the North Creek Electric Company, North Creek, N. Y. The narrative is handsomely illlustrated and shows how a 200-kw development was made on a small stream in the Adirondacks, where a head of about 600 ft. could be utilized. Special attention is paid to the building of the pipe line. The story, which is worth reading for its own sake, is sent free on request.

VOLTAGE REGULATORS.—Central-station service has been very much improved of late years by the installation of regulating devices by means of which a constant voltage is maintained at the lamp terminals. More recently manually operated apparatus has given place to automatically operated apparatus, with a consequent reduction in the operating forces and greater improvement in the service. Various types of potential regulators built by the General Electric Company are briefly described in Bulletin No. 4793, the description being preceded by general information pertinent to the subject.

SIGNS AND FLASHERS.—The Sun Electrical Company, Limited, of London, England, has issued Catalog No. 204 dealing with its signs and flashers. The company's "Kaleidoscope," "Mirrorgraph" and "Collapsible" signs are featured, together with a magnetic, mercury-contact type of flasher. In the latter the contacts between switch points are made by mercury working in a vacuum, the magnetic switch to which it is attached being in shunt to the main circuit. As the armature rocks against the tension of a spring it works a train of wheels attached to an air vane, thus regulating the time elapsing between each movement of the mercury tube, and hence between flashes.

MOORE TUBES.—The Western Electric Company has issued Bulletin No. 9465, describing the Moore tube lamp for color matchnig. This is stated to be the only artificial illuminant which gives exact daylight color values, and is being introduced into shops, mills and other establishments where color values are of great importance. As is well known, this consists of a means for a vacuum producing light by passing alternating current through highly rarefied carbon dioxide gas confined within a continuous clear glass tube. The bulletin contains a description of the arrangement and of its uses and operation. A page is devoted to the list of concerns now using the lamp and another to tabulated dimensions, data, etc.

STORAGE BATTERY.—The Edison Storage Battery Company, Orange, N. J., has issued an enlarged catalog containing complete and useful information on the various Edison cells and the diversified application of the Edison battery for pleasure and commercial electric vehicles, ignition and lighting work, industrial truck, locomotive and omnibus work and in connection with electric traction systems. Comparisons, said to be based on actual experience with and observations of lead cells of the best construction, are given of the Edison and lead battery. The company is now manufacturing five sizes of cells, identical in electrical characteristics and differing only in the number and size of plates and capacity.

NON-MULTIPLE TOLL SWITCHBOARDS.—The Western Electric Company has just issued Bulletin No. 1006, describing non-multiple toll switchboards. The apparatus presented in this bulletin is recommended for use as toll boards in either magneto or central battery exchanges, and also as magneto exchange switchboards where a desk type board is desired or a switchboard with a lower key-shelf than is ordinarily provided on local boards. The boards described are divided into two general types, those having self-restored line signals and those with manually restored line signals. Considerable space is devoted to the combined jacks and signals used with the first type of boards. The bulletin, which contains thirty-six pages, is illustrated with many photographs and diagrams and contains a table showing the capacity of standard types of non-multiple toll switchboards.

BUSINESS NOTES.

F. N. MANROSS & SONS.—The firm of F. N. Manross, of Forestville, Conn., has changed its name to F. N. Manross & Sons.

THE PELTON WATER-WHEEL COMPANY has moved from 1396 Monadnock Building to No. 2231 Harrison Street, San Francisco, Cal.

ANDERSON CARRIAGE COMPANY, Detroit, Mich., manufacturer of the Detroit electric vehicles, has changed its corporate name to the Anderson Electric Car Company.

THE COLUMBIA METAL BOX COMPANY has moved to 226-228 East 144th Street, New York City, to occupy its new five-story and basement factory building. The removal and enlarged quarters were necessitated by a rapidly growing demand for the company's switchboards, panel boards, cut-out boxes and other specialties, and in the new quarters the former equipment is more than doubled.

ELECTRICAL PLANT FOR CEMENT WORKS.—The Knickerbocker Portland Cement Company, of Hudson, N. Y., has ordered from the General Electric Company the following apparatus: Two 2000-kw, 1800 r.p.m. turbo-generators; one 75-kw, 125-volt, non-condensing turbo-generator; twenty-four 75-hp, 400 r.p.m., vertical motors; one 50-kw motor-generator set; forty-seven three-phase, 60-cycle, 440-volt induction motors, aggregating 887 hp.

MICHIGAN ELECTRIC WELDING COMPANY.—As previously announced in these columns, the Agnew Electric Welding Company, of Detroit, has changed its name to the Michigan Electric Welding Company. The present location of the company is at the corner of Third and Congress Streets, Detroit, the new quarters consisting of a one-story brick building on this corner which is 35 ft. x 60 ft. and in the rear a two-story building approximately 25 ft. x 65 ft. In addition to this there is a large storeroom. The company has installed additional machinery and is now in excellent shape to handle job welding and manufacturing for the trade in its territory. A specialty is being made of automobile work, and rod and yoke end assemblies are furnished complete, together with other parts, like the welding of tubular reach, torsion and radius, torque tubes, drag links, fore-and-aft connections, propeller shafts; also welding of any sort of forgings and parts that can be welded to rods, shafts or tubes and other job welding that can be done to advantage.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 17, 1911.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

981,601. MEANS FOR CONTROLLING ELECTRICALLY DRIVEN CENTRIFUGAL MACHINES; C. A. Adams, Cambridge, Mass. App. filed Apr. 3, 1907. For use in sugar houses. The centrifugal is combined with an electric motor with shunt field whose armature is in a loop circuit connected with the two mains, the direct connection between armature and one main being broken, and the loop circuit closed to cause a reversal of current through the armature, at which time a brake actuating coil is thrown in to assist the reverse current in stopping the machine.

981,612. STARTING DEVICE; C. E. Carpenter, New York, N. Y. App. filed May 17, 1907. For electric motors, the controller having a movable arm, a slidably mounted circuit breaker arranged to be set by the arm when in a predetermined position, the circuit breaker having a main and an auxiliary contact, a retaining device for the circuit breaker and means responding to abnormal increase in current in the motor circuit for releasing the same.

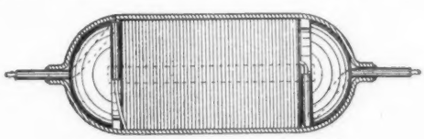
981,690.—Heat-Dissipating Means for Electrical Apparatus.

981,622. ELECTRIC VEHICLE CHARGING WALL SOCKET AND PLUG; J. N. Davis, Denver, Colo. App. filed June 1, 1909. Wall socket and plug for charging the storage batteries of electrically-operated vehicles, the plug having separated electrodes and a body and handle with a central web projecting from the body, the web forming a barrier between the contacts.

981,623. DYNAMO-ELECTRIC MACHINE; W. F. Dawson, Schenectady, N. Y. App. filed May 5, 1905. Ventilator for magnetic cores and conductors, ventilating spaces being arranged between groups of the laminated plates and deflectors in the spaces with inclined radial ends.

981,637. HOOD SUPPORT FOR CABLE TERMINALS; E. L. Grauel, Troy, N. Y. App. filed April 9, 1910. A movable sheet-metal hood with a rod supported parallel with the line of movement of the hood and a dog or catch upon the hood with a restricted passageway for the rod with a shoulder engaging the hood to hold the same under tension.

981,662. TRANSFORMER FOR ELECTRIC METAL WORKING APPARATUS; L. S. Lachman, New York, N. Y. App. filed Feb. 9, 1909. A transformer secondary having two rigid turns in parallel planes and adapted to move longitudinally with relation to each other.



981,718.—Incased Induction Coil.

981,690. HEAT-DISSIPATING MEANS FOR ELECTRICAL APPARATUS; H. A. Rhodes, Denver, Col. App. filed Sept. 13, 1909. A spool with layers of sheet metal foil between the conductors, the extremities of the sheets being slit and bent into engagement with the spool to dissipate heat.

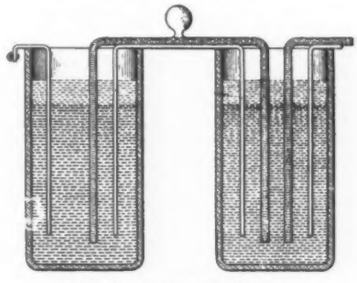
981,692. ELECTRIC SWITCH; H. R. Sargent, Schenectady, N. Y. App. filed March 19, 1900. An electric switch with an actuating spindle, a retainer, a spring tensioned by the spindle, a support with cam slot and a projection on the spindle engaging the slot to move the carrier out of engagement with the retainer so that the spring forces the carrier back.

981,713. ELECTRIC LOCOMOTIVE; N. W. Storer, Pittsburg, Pa. App. filed March 2, 1908. The cab has a central platform for the auxiliary apparatus leaving a passageway for doors and openings. The motors and running gear extend into the recess in the floor of the cab.

981,718. INCASED INDUCTION COIL; H. C. Thomson, Boston, Mass. App. filed March 6, 1909. An induction coil with metal-incased conductors connected to the terminals of the coil and a metallic casing inclosing and sealing the coil, leakage proof joints between the conductors and the casing.

981,727. MEANS FOR ELECTRIC-ARC REACTIONS OF GASES; O. Weber & G. Schreiber. App. filed March 7, 1910. For generating and maintaining arcs of great lengths and subjecting gases to the action of the arc by directing the gases at an acute angle to the length of the arc, gases being supplied in excess for the purpose of cooling.

981,734. SNAP SWITCH; J. A. York, Hartford, Conn. App. filed Aug. 12, 1907. Rotating snap switch with catch and trip and switch-bar connected to the trip, a spindle and coupler connecting the spindle and trip.



581,760.—Protective Device.

981,742. LIGHTNING ARRESTER; E. J. Berg, Schenectady, N. Y. App. filed June 1, 1907. A reactance connected in series with the conductor to be protected, condenser plates connected on each side of the reactance and a condenser plate connected to ground and in inductive relation to the first mentioned plates.

981,759. SWITCHING DEVICE; F. W. Harris, Wilkinsburg, Pa. App. filed May 9, 1908. A horizontal rotatable shaft with hand-lever rotatably mounted thereon, a latch at one end of the lever, with automatic means for tripping the latch, and for preventing withdrawal of the latch when the shaft is in a certain position.

981,760. PROTECTIVE DEVICE; J. L. R. Hayden, Schenectady, N. Y. App. filed April 6, 1909. A plurality of cells each including a vessel containing an electrolyte and two electrodes terminating therein, the electrodes of the cells being connected in series and a siphon between adjacent cells being filled with an electrolyte to form an electrical connection between the cells, the siphon having a gas retainer at its highest point.

981,764. LIGHTNING ARRESTER; R. P. Jackson, Wilkinsburg, Pa. App. filed Dec. 3, 1906. A supporting frame carries a plurality of two-point electric discharge members mounted on insulators with two groups of single-point discharge members mounted on insulators adjacent thereto, and two groups of fuses and a cut-out switch.

981,798. FILLER FOR COILS AND THE LIKE; G. H. Rupley, Schenectady, N. Y. App. filed Aug. 7, 1907. For use with "transil" oil consisting of copal gum and carnauba wax.

981,799. ELECTRIC LOCOMOTIVE; W. Schaake, Pittsburg, Pa. App. filed Feb. 24, 1908. The wheel-base, although long, does not interfere with movement upon curves, and consists of a frame with a foot upon the bearings for the axle above the axle and vertical posts secured to the respective feet with spring upon the posts having their ends secured to the frame.

981,803. OIL GUARD FOR COMMUTATORS; R. Siegfried, Pittsburg, Pa. App. filed Oct. 3, 1905. A commutator spider with rim and annular projection for diverting lubricating fluid from the commutator and a V-shaped clamping ring with external angular projection for diverting lubricating fluid.

981,806. TRACTION ELEVATOR CONTROL; R. C. Smith, Yonkers, N. Y. App. filed Sept. 23, 1907. Motor control including a shunt motor, resistances in series with the shunt field, a switch for controlling the resistance operated by an electromagnet with means for closing the circuit through the magnet on starting, accelerating mechanism for the motor and short-circuiting switch for the electromagnet.

981,816. CIRCUIT INTERRUPTER; H. R. Stuart, Wilkinsburg, Pa. App. filed Feb. 6, 1908. Circuit interrupter with movable and sta-

tionary contacts, and operating an electromagnet and means for applying a closing force to the movable member, constant until the end of the movement and increased to bring the members into engagement.

981,821. CONTACT MEMBER FOR ELECTRIC SWITCHING DEVICES; C. A. Tucker, Edgewood Park, Pa. App. filed July 6, 1908. A switching device with a stationary terminal and a contact block secured thereto by a lost-motion connection, with a coöperating contact terminal and a flexible tubular shunt surrounding the lost-motion connection and having its ends fastened to the terminal and block.

981,823. ELECTRIC SWITCH; C. S. Van Nuis, New Brunswick, N. J. App. filed Jan. 23, 1907. Knife switch with base and slot, opposed ribs and a pair of clips adjustably secured together and separated to form the space for the blades and adjustable means for resisting distortion of the clips.

981,845. TELEGRAPHY; P. B. Delany, South Orange, N. J. App. filed March 23, 1907. For private, secret service. Sending part of a letter over one circuit and another part over another circuit and uniting both parts in their proper relation by a common receiver.

981,846. KEY SPACE; A. F. Dixon, Newark, N. J. App. filed June 11, 1910. For telephone exchange switchboards, the key space comprising a body portion having a notched portion at each end and laterally projecting locking members located near each end of the body.

981,847. ELECTRIC CONTROLLER; A. C. Eastwood, Cleveland, O. App. filed Sept. 22, 1910. Separately-actuated magnetic switches are used to make the connection for starting the motor, operating it in different direction and varying the speed controlled by a master controller with a locking-nut coil on the main switch which is energized when any of the resistance switches is closed, and prevents operation of the main switch.

981,848. ELECTRIC CONTROLLER; A. C. Eastwood, Cleveland, O. App. filed Sept. 24, 1910. See 981,847. A magnetically-operated switch has its applied voltage automatically reduced to prevent its operation so that the initial switch fails to close, the initial switch closing the circuit through the resistance.

981,850. SMELTING PROCESS AND APPARATUS THEREFOR; R. Fleming, New Rochelle, N. Y. App. filed July 13, 1909. For making copper matte by maintaining a long and narrow layer of electrically-heated matte in an inclosed chamber and continuously feeding heated ores and removing matte and slag therefrom.

981,864. ELECTRIC HORN; J. Lanz, Danbury, Conn. App. filed Aug. 18, 1910. An electric horn with space diaphragms carrying contacts normally touching an electromagnet for vibrating the inner diaphragm and causing the outer diaphragm to be mechanically vibrated.

981,865. TROLLEY RETRIEVER; R. F. Levens & A. H. Whatley, Providence, R. I. App. filed Dec. 7, 1907. A reel which takes up slack in the rope and an electromagnet for holding the pulley which pulls down the rope out of operation, the magnet being de-energized when the trolley wheel leaves the wire.

981,881. ELECTRICAL MOTOR; H. A. Rhodes, Denver, Colo. App. filed Sept. 13, 1909. Rotating shaft carrying a large number of radial electromagnets wound to form the field, revolving inside of a stationary set of curved steel plates arranged eccentrically with relation to the magnets so as to vary the air-gap.

981,900. PROCESS FOR PRODUCTION OF COMPOUNDS OF PER SULPHURIC ACID; G. Teichner, Nuremberg, Germany. App. filed Feb. 8, 1901. Electrolizes the acid, cools the anode and maintains the solutions at a higher temperature than the anode.

981,919. SAFETY DEVICE FOR ALTERNATING-CURRENT HOISTING APPARATUS; W. N. Dickinson, Jr., New York, N. Y. App. filed June 14, 1906. A motor, with a brake and a multiphase electromagnet having an armature closing the magnetic circuit thereof, the magnet and armature being connected between the brake and the actuating mechanism.

981,922. ELECTROLYTIC SHIP CLEANER; G. W. Frazier, Pittsburg, Pa. App. filed Nov. 28, 1908. Has a floating central station with electrodes to be applied to the side of the ship, the electrodes being supported in the water and the metal exterior of the ship being likewise connected to a current supply.

981,930. ALTERNATING-CURRENT POTENTIAL SWITCH; D. Larson, Yonkers, N. Y. App. filed May 7, 1908. A switch with a small electromagnet including a magnet coil and magnet frame with a pole extending into the coil, and switch arm of magnetic material, a pole piece movable into the coil, the magnetic circuit being completed outside of the coil through the switch arm.

981,931. ALTERNATING-CURRENT ELECTROMAGNETIC SWITCH; D. L. Lindquist, Yonkers, N. Y. App. filed May 7, 1908. An electric switch with means for opening the switch, a strong spring acting as a resilient abutment when the switch is closed, a spring for closing the switch and a support for both springs.

981,933. SNAP CONTACT; R. W. Magna, Holyoke, Mass. App. filed Dec. 16, 1908. For connecting with binding posts of electric batteries by means of a clip with pivoted spring-pressed jaws and longitudinal jaws screw-threaded to insure an interlocking engagement with the screw-threaded binding posts.

981,948. HOLDER FOR IRRADIATING APPARATUS; J. Rosenthal, Munich, Germany. App. filed March 9, 1908. A holder for a radiating apparatus with a supporting pillar, holding frame and a connecting arm between the pillar and the frame with a clamp in which the pillar and arm are slidably-mounted and a lock for locking the clamp on the pillar.

981,987. ELECTRIC CIGAR LIGHTER; V. E. Extrom & T. G. Boardman, Tomahawk, Wis. App. filed March 25, 1910. The wires to be heated are supplied with current by a step-down transformer so as to use larger current, controlled by a push button.

981,996. TEMPERATURE ALARM; A. Goldstein, New York, N. Y. App. filed March 28, 1910. A pipe in loop form with open ends and diaphragm opposite thereto controlling terminals which actuate a circuit and alarm.

981,997. SIGNAL TELEGRAPH; A. Goldstein, New York, N. Y. App. filed March 28, 1910. For sending signals from the different floors of the building by a single code wheel controlled by throwing out a switch at each floor.

981,998. ELECTRICAL THERMOSTATIC ALARM SYSTEM; A. Goldstein, New York, N. Y. App. filed May 2, 1910. An electrical thermostat including a case with a diaphragm operated by air expansion, the diaphragm making and breaking the circuit, the break alone operating an alarm.

982,006. PIPE AND CONDUCTOR COUPLING; C. H. Kayser, New York, N. Y. App. filed April 13, 1910. For connecting thin metal pipes containing conductors for high temperature lines by means of elastic packing rings, the conducting wires extending through openings in the walls of hollow cylindrical terminals in the rings and being wound around the terminals.

982,032. CONTROL OF ELECTRICALLY-OPERATED SWITCHES; E. R. Carichoff, Schenectady, N. Y. App. filed Sept. 19, 1910. The switches are operated in succession by electromagnet for controlling electric motors on trains. A two-wire notching controlled system is so arranged that the contactors are prevented from operation until one of the switch members of the relay mechanism has operated and closed certain contacts causing a reduction of resistance in the actuating circuit. One contactor cannot close until the actuating circuit of the succeeding contactor has been interrupted at the relay.

982,033. EMERGENCY OPERATING MEANS FOR REVERSING SWITCHES; F. E. Case, Schenectady, N. Y. App. filed Sept. 30, 1909. An electrically-operated reverser with operative abutments actuated by fluid pressure, a controller, a valve mechanism connected with the reversing handle of the controller for admitting fluid pressure to the abutment.

982,037. ELECTROLYTIC CELL; J. R. Crocker, New York, N. Y. App. filed Sept. 30, 1909. For electrolizing salt and the recovery of caustic soda. The cell includes an anode and a cathode diaphragm comprising a supporting wire screen which is inclined together with asbestos paper and cloth in engagement with the screen, the diaphragm being impregnated with zinc oxide.

982,041. MOTOR CONTROL; W. N. Dickinson, Jr., New York, N. Y. App. filed July 3, 1906. For starting single-phase motors by means of a reversing switch, a brake, a brake-releasing magnet and a switch operated by the magnet for controlling the reversing switch.

982,052. ELECTRICAL SYSTEM FOR THE SUPERVISION OF WATCHMEN; A. Goldstein, New York, N. Y. App. filed May 10, 1910. A line circuit with an automatic transmitter operating at predetermined intervals, a telephone circuit with manual control for preventing signal transmission and an automatically-operating device for intermittently connecting the telephone to line.

982,067. ALTERNATING CURRENT MOTOR CONTROL; J. D. Ihlder, New York, N. Y. App. filed Jan. 15, 1907. An electric motor with a starting resistance, accelerating-magnet switches normally short-circuiting it auxiliary resistances normally connected to a part of the motor, the accelerating switches controlling means for cutting out the auxiliary resistances.

982,074. SAFETY SLOW-DOWN AND STOP MOTION FOR ELECTRIC ELEVATOR; D. Larson, Yonkers, N. Y. App. filed May 18, 1909. Two switches connected in parallel and a circuit-breaker operating to slow down the elevator when both switches are opened at the same time.

982,097. ELECTRODE FRAME AND HANGER; C. B. Schoenmehl, Waterbury, Conn. App. filed Feb. 9, 1910. A negative plate with a frame for engaging edges of the plate with a horizontal top portion, with a single suspending rod and having elongated head with additional means upon the rod for securing the rod and horizontal portion together.

982,100. SOLENOID-OPERATED SWITCH; H. L. Smith, Schenectady, N. Y. App. filed June 8, 1906. Provides a connection between the core and switch arm operated thereby which permits the core to respond to variations in current, but maintains a constant pressure between the contacts when the switch is closed regardless of the variations of pull exerted by the core on variation of current supply.

982,110. OUTLET-BOX SUPPORTING BRACKET FOR ELECTRIC WIRING FIXTURES; S. Adelman, Chicago, Ill. App. filed March 15, 1910. An outlet-box with a thin metal bracket perpendicular to the box secured thereto for attaching it to a stretcher in the ceiling.

982,116. CIRCUIT BREAKER; H. P. Hall, New York, N. Y. App. filed June 17, 1908. Calibrating device for electromagnets, comprising a trip coil, a rotating operating handle of the adjustable stop clamped by the rotation of the handle.

982,119. VAPOR ELECTRIC APPARATUS AND METHOD OF OPERATING THE SAME; C. O. Bastian, London, England. App. filed April 28, 1910. A positive electrode of solid material, an exhaustive envelope surrounding it, a column of mercury below the envelope connected thereto, a second column of mercury carried by the envelope and a solid metallic connection between the first and second columns.

982,135. METHOD OF PRODUCING FERROBORON; C. A. Hansen, Schenectady, N. Y. App. filed Dec. 22, 1908. Heats an alkaline earth consisting of boron in the presence of silicon and a metal forming an alloy with boron.

982,146. ELECTROMAGNETICALLY-OPERATED SWITCH; C. B. Larzelere, Seneca Falls, N. Y. App. filed Aug. 2, 1910. A contactor with a relay and a mechanical connection between the contactor and relay whereby the contactor when opening opens the relay contacts and a latch holding the relay open which is tripped by the contactor in closing.

982,175. ELECTRICAL AGRICULTURAL SYSTEM; C. S. Doney, Columbia Falls, Mont. App. filed April 5, 1910. The field is provided with a power house and positive and negative feed wires on opposite sides which supply current to a traveling trolley system of trolley wires, the trolley wires supplying current to the plow or agricultural implement.

982,193. OUTLET BOX; F. I. Thayer, Farmington, N. H. App. filed Sept. 15, 1910. An outlet box to be incorporated in a wall for engagement with the lathes and plaster of the partition. Details.

982,209. BRIDGING TELEPHONE SYSTEM; H. F. Joeckel, Camp Point, Ill. App. filed Feb. 21, 1910. Balanced metallic talking-line current and ground return signaling line circuit, insulated from each other, in a party line bridging telephone system.

982,213. TELEPHONE SWITCH APPARATUS; S. A. Koltonski, Boston, Mass. App. filed Jan. 21, 1910. A two-part frame, the inner part carrying the circuit springs including those operated by the receiver hook and forming a unit, and the outer part carrying the switch-operating devices, including the receiver-hook lever.

982,224. LIGHTNING ARRESTER; E. E. F. Creighton, Schenectady, N. Y. App. filed July 6, 1909. An electrolytic lightning arrester wtih a horn spark gap in series therewith and a lever carrying a wiper for passing through the gap, together with many improvements in the system.

982,227. APPARATUS FOR PRODUCING OZONE; L. Glaser, Pankow, Germany. App. filed July 20, 1907. A conductor of a certain class is mounted on the shaft of the motor and rapidly moved through the air in a casing, and a resistance with high positive temperature coefficient is connected in series with conductor to prevent it from losing conductivity by cooling.

982,228. MERCURY VAPOR APPARATUS; J. T. H. Dempster, Schenectady, N. Y. App. filed March 6, 1905. A vapor-electric apparatus with a movable diaphragm actuating an electrode and electromagnetic means for moving the diaphragm.